

FOR REFERENCE

NOT TO BE TAKEN FROM THIS ROOM

AN APPROXIMATION OF STOCKOUT
PROBABILITIES IN INVENTORY
ROUTING PROBLEM

by

Ş. Şükrü Saraçoğlu

B.S. in I.E., Boğaziçi University, 1983

Bogazici University Library



39001100314734

14

Submitted to the Institute for Graduate Studies in
Science and Engineering in partial fulfillment of
the requirements for the degree of

Master of Science
in
Industrial Engineering

Boğaziçi University

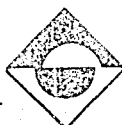
1985

ACKNOWLEDGEMENTS

I wish to express my deepest gratitude to Doç. Dr. İlhan Or for introducing me this topic, and for his invaluable guidance and supervision throughout this thesis.

I also thank Doç. Dr. Ali Rıza Kaylan and Doç. Dr. Bülent Sankur for their interest and evaluation as members of the thesis committee.

At last I want to thank Alper Oysal for the painstaking typing.



ABSTRACT

One of the most important variant of the well-known Vehicle Routing Problem is Inventory Routing Problem. We are concerned with the stochastic aspects of this problem. Though a closed form for the stockout probability expression is not available for even simplest form of demand distributions, problem is tried to be solved by using a simplified approximated expression. We test the validity and reliability of the expression with simulation methods, then we deal with the causes of the error resulting from the approximation. Finally by regression methods we estimate a multiplier which minimizes our error.

Ö Z E T

Taşıt Yol Atama probleminin en önemli kollarından biri Sayımcalı Yol Atama Problemidir. Bu çalışmada problemin rassal yönüyle ilgilenilmiştir. En yalın istem dağılımları için bile stok kopma olasılığının kapalı tanımı olmadığından problem bir yaklaşıklama tanımı kullanılarak çözülmeye çalışılmıştır. Benzetim yöntemiyle bu tanımın geçerlilik ve güvenilirliği sınanılmış, yaklaşıklamadan kaynaklanan yanılmanın nedenleriyle ilgilenilmiştir. Sonunda, yanılmayı enküçükleyen bir katsayı regresyon yöntemi yardımıyla kestirilmiştir.

TABLE OF CONTENTS

	<u>Page</u>
Acknowledgements	iii
Abstract	iv
Özet	v
I. INTRODUCTION	1
II. PROBLEM DEFINITION	8
2.1 Statement of the problem and variance approach	8
2.2 Elimination of parameters	13
2.3 P1P2T	14
2.4 P1DP2T	22
III. SIMULATION	26
3.1 Real probability value	26
3.2 Table probability value	31
3.3 P1DP2T	32
3.4 Approximation of the Error Curve in the Interval (EII_{cr_1}, ∞)	38
3.5 Approximation of the Error Curve in the Interval $(-\infty, EII_{cr_1})$	43
IV. DISCUSSION OF THE ALGORITHM	51
V. COMPARISON OF ERRORS	54
REFERENCES	57
Appendix I	58
Appendix II	77
Appendix III	78
Appendix IV	84

I. INTRODUCTION

Inventory Routing Problem is an important variant of the well-known Vehicle Routing Problem, where additional consideration is given to vehicle time constraints as well as to inventory fluctuations and stockouts.

There are N demand nodes and a single supply node. The storage capacity SC_i is given for all demand nodes $i = 1, \dots, N$. The daily requirements ξ_q^i of demand node i in day q are independent and identically distributed random variables with known expected values $R_i = E[\xi_q^i]$ and variances $\sigma_i^2 = \text{Var}[\xi_q^i]$ for all $i = 1, \dots, N$.

Let the planning horizon be Q delivery periods, and let $I_{i,q}$ be the amount of goods left in inventory from day q to day $q+1$ at node i , for $q = 0, 1, \dots, Q-1$. Assume that deliveries to demand nodes replenish inventories up to their capacities and that deliveries made to node i in day q may be used to meet requirements of day q . Then, $I_{i,q}$ is a random variable dependent not only on daily demands, but also on the date of last delivery, which we call t_i . Since last delivery must

have occurred before the start of the planning horizons, t_i must be less than zero.

A stockout is said to occur on day q if the amount of goods available at node i on day q is not enough to satisfy daily requirement ξ_q^i . A stockout implies certain penalties and an immediate emergency shipment to replenish the inventory up to its capacity.

Suppose the decision policy is to make deliveries to node i on day q of the planning horizon. Then a stockout may occur on days $1, 2, \dots, q-1$ and only if the event :

$$\left\{ \sum_{r=t_i}^{q-1} \xi_r^i > SC_i \right\} \text{ occurs.}$$

Furthermore the way parameter t_i is defined implies that event:

$$\left\{ \sum_{r=t_i}^0 \xi_r^i \leq SC_i \right\} \text{ has occurred. Otherwise, the logic of the}$$

model would imply an emergency shipment to node i at same time \bar{t} ($t_i, 0$). However, that contradicts the assumption that t_i is the date of last replenishment to node i . Then stockout probability is:

$$P_{iq} = P \left\{ \sum_{r=t_i}^{q-1} \xi_r^i > SC_i / \sum_{r=t_i}^0 \xi_r^i \leq SC_i \right\} \quad (1)$$

There are two types of costs in the system:

- a) Operating Costs: These are the cost associated with making deliveries to demand nodes.
- b) Stockout Costs: These are the costs associated with not making deliveries to demand nodes. A stock cost is incurred if a stockout occurs anytime during the planning horizon.

The objective is to minimize total stockout and delivery costs of all nodes over a fixed planning horizon of Q delivery periods (days), while satisfying routing constraints. It will also be assumed that the date of the last delivery to node i , t_i , is known for all nodes $i = 1, \dots, N$.

In this research we will analyze the stochastic aspect of the problem, especially the stockout probabilities that were mentioned.

Unfortunately, a closed form or simple and accurate approximations for the probability expression in (1) is not available for most probability distributions for ξ_r^i .

On the other hand, if we compute expected stock level at the beginning of the planning horizon, e_i .

$$e_i = E[I_{i,0} / \sum_{r=t_i}^0 \xi_r^i \leq SC_i] \quad (2)$$

$$\text{where } I_{i,0} = SC_i - \sum_{r=t_i}^0 \xi_r^i$$

and redefine the probability of a stockout at node i before day q as;

$$P_{iq} = P\left\{ \sum_{r=1}^{q-1} \xi_r^i > e_i \right\}$$

$$\phi_i^m(b) = P\left\{ \sum_{r=1}^m \xi_r^i \leq b \right\}$$

Then it leads to

$$e_i = E\left[SC_i - \sum_{r=t_i}^0 \xi_r^i / \sum_{r=t_i}^0 \xi_r^i \leq SC_i \right]$$

$$= SC_i - \left[\frac{1}{P\left\{ \sum_{r=t_i}^0 \xi_r^i \leq SC_i \right\}} \right] \left[\sum_{u=0}^{SC_i-1} P\left\{ u < \sum_{r=t_i}^0 \xi_r^i \leq SC_i \right\} \right]$$

$$= SC_i - \frac{(SC_i) \phi_i^{1-t_i}(SC_i) - \sum_{u=0}^{SC_i-1} \phi_i^{1-t_i}(u)}{\phi_i^{1-t_i}(SC_i)}$$

$$e_i = \frac{\sum_{u=0}^{SC_i-1} \phi_i^{1-t_i}(u)}{\phi_i^{1-t_i}(SC_i)}$$

which means that e_i can easily be estimated in terms of R_i , σ_i , t_i and SC_i .

Furthermore;

$P_{iq} = 1 - \phi_i^{q-1}(e_i)$ which can also be estimated in terms of R_i , σ_i , q and e_i .

Examples: (ξ_r^i normally distributed)

1.i) $R_i = 2$ $\sigma_i^2 = 2$ $t_i = -5$ $q = 5$ $SC_i = 18$

$$e_i = \frac{\sum_{u=0}^{17} \phi_i^6(u)}{\phi_i^6(18)} = 7 \qquad P_i = 1 - \phi_i^4(7) = .9099$$

1.ii) $R_i = 2$ $\sigma_i^2 = 2$ $t_i = -5$ $q = 5$ $SC_i = 24$

$$e_i = \frac{\sum_{u=0}^{23} \phi_i^6(u)}{\phi_i^6(24)} = 13 \qquad P_i = 1 - \phi_i^4(13) = .0901$$

Unfortunately, P_{iq} estimation (from now on we will call it table estimation) may lead us to wrong conclusions especially in low stockout probability regions. The following figure shows us the relation between the real and table probabilities.

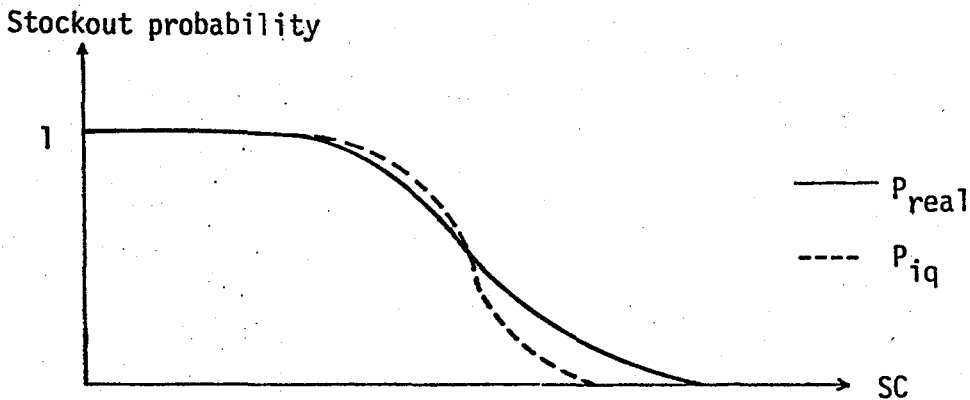


Figure 1.1 Constant R_i , σ_i , t_i , q_i values

As it is seen from Figure 1.1 overestimation occurs at high stockout probability regions and underestimation occurs at low stockout probability regions. Fixing random variable $I_{i,0}$ into one specific point (e_i) results in such errors.

Figures 1.2a and 1.2b shows how overestimation and underestimation occurs.

We want to find the stockout probability (P_{iq}) for known values i and q at time zero. We don't have any information about our stock level at time zero, we only know the replenishment time (t_i), and that any stockout has not occurred till that time. $I_{i,0}$ is a random variable which shows us the stock level of node i at the end of time zero.

$$I_{i,0} = SC_i - \sum_{r=t_i}^0 \xi_r^i \geq 0$$

Underestimation:

Suppose the relation between random variable ξ_r^i , $r = 1, \dots, q$ and e_i are such that $P\left\{\sum_{r=1}^q \xi_r^i > e_i\right\} \approx 0$ whereas $P\left\{\sum_{r=1}^q \xi_r^i > \bar{I}_{i,0}\right\} > 0$ for at least some possible outcomes $\bar{I}_{i,0}$ of random variable $I_{i,0}$. Then the real stockout probability will be larger than the table estimator.

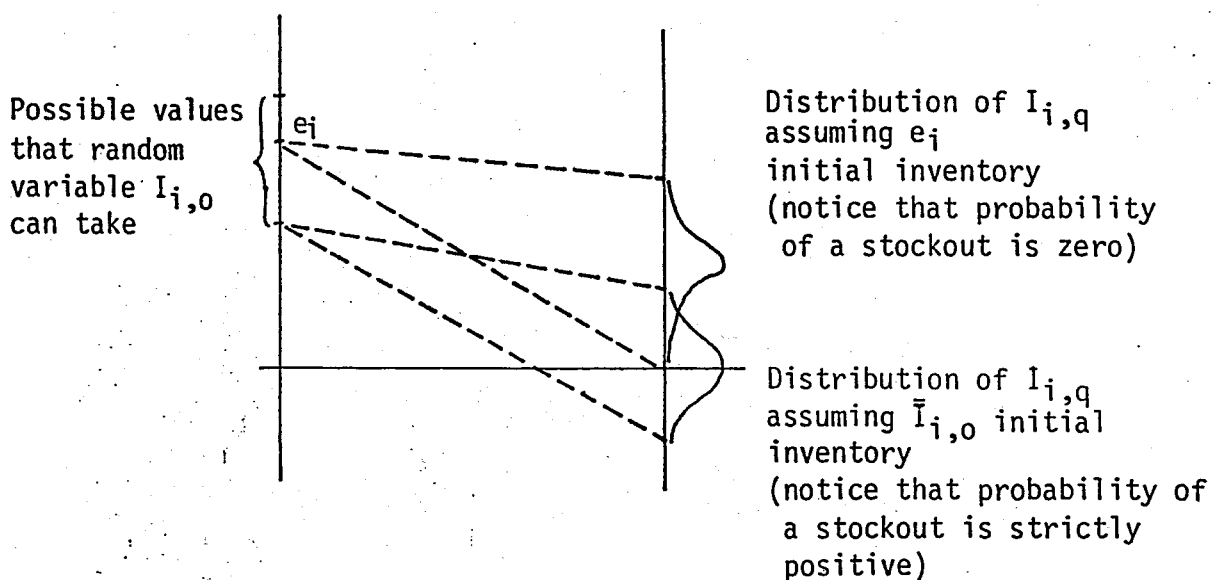


Figure 1.2a

Overestimation:

Suppose the relation between random variable $\xi_{i,j}$, $j = 1, \dots, q$ and e_i are such that $P\left\{\sum_{r=1}^q \xi_r^i > e_i\right\} \sim 1$. Whereas $P\left\{\sum_{r=1}^q \xi_r^i > \bar{I}_{i,0}\right\} < 1$ for at least some possible outcomes $\bar{I}_{i,0}$ of random variable $I_{i,0}$. Then the real stockout probability will be smaller than the table estimator.

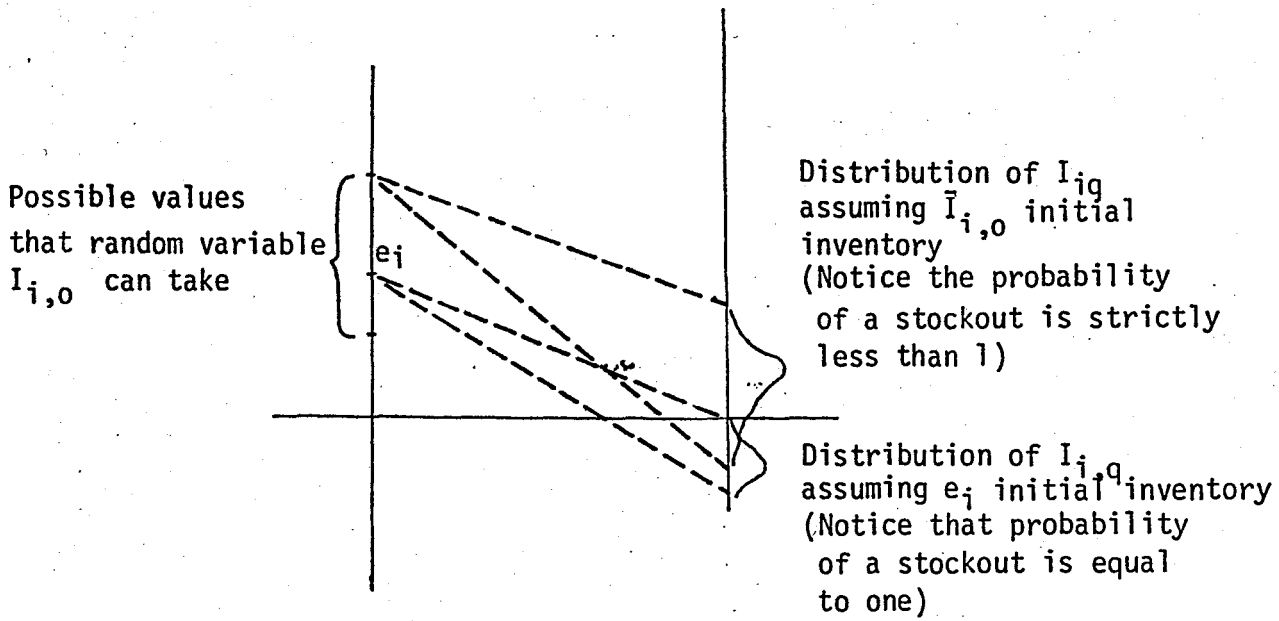


Figure 1.2b

We try to rearrange the stockout probability by the help of relationships between our variables (t_i , q_i , R_i , σ_i , and SC_i) and error deviation. We will analyze these relationships at the following chapters.

II. PROBLEM DEFINITION

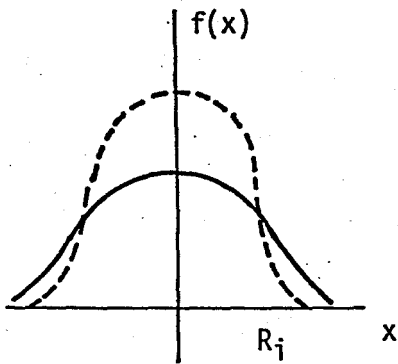
2.1 Statement of the Problem and Variance Approach

In the previous section, we saw that, it is possible to estimate the stockout probability but the approximated estimation led us to overestimation or underestimation depending on values of parameters. We firstly deal with the error percentage of the estimation. By a simulation model we check if the magnitude of the error is negligible. Results of the simulation shows us that, especially for low stockout probabilities and high t_i values the error percentage is not negligible. We will explain the simulation model we use, in the next chapter. Appendix 1 includes the results of this simulation study.

In this chapter first we try to solve the problem only by dealing with periodic variances.

Variance Approach

We briefly mentioned the causes of the error in the introduction part. Now we shall look at our problem from a different point of view (Variance Approach). Let us examine the structure of 2 normal distributions which have the same mean but different variances.



————— 1st curve
 - - - - - 2nd curve

$$\sigma_1^2 > \sigma_2^2$$

$$R_1 = R_2$$

Figure 2.1

Assume $F(x)$ the cumulative of $f(x)$. Then $F(x_1) = \int_{-\infty}^{x_1} f(x) dx$.

Plotting $(1-F(x))$ versus x we get the following figure for both distributions.

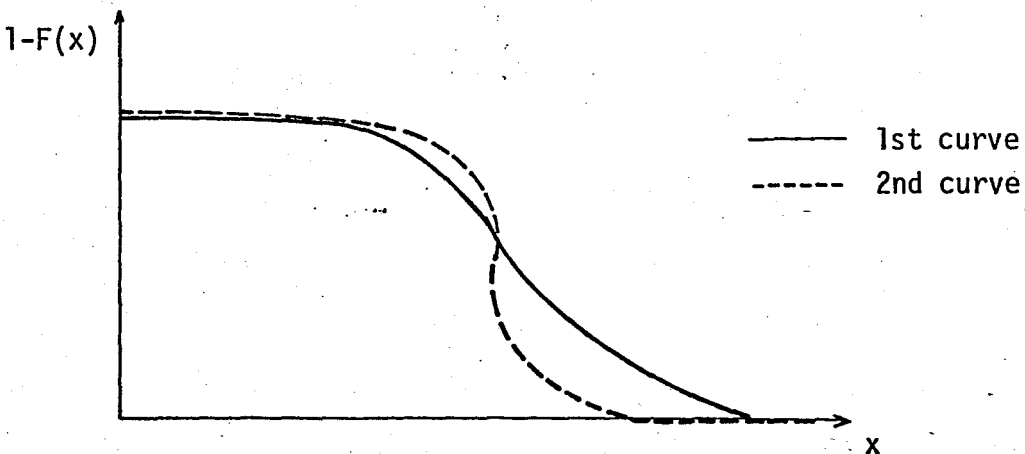


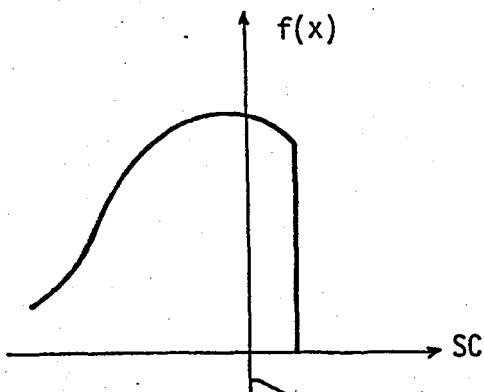
Figure 2.2

The behavior of the 2nd curve with respect to the 1st one looks like the behavior of the table probability with respect to the real probability. So we can say that using table, affect our results in the direction of reducing the variance.

In our study we will first assume that demand is normally distributed with expected values $R_i = E[\xi^i]$ and variances $\sigma_i^2 = \text{Var}[\xi^i]$ for all nodes $i = 1, \dots, N$. We will assume that planning horizon starts at time $t = 0$ and that the date of last replenishment date of node i , the following statement is true for all nodes $i = 1, \dots, n$ $\{ \sum_{r=t_i}^0 \xi_r^i \leq SC_i \}$.

We will call the time interval $[t, 0]$ the first period and $0, q-1$ the second period.

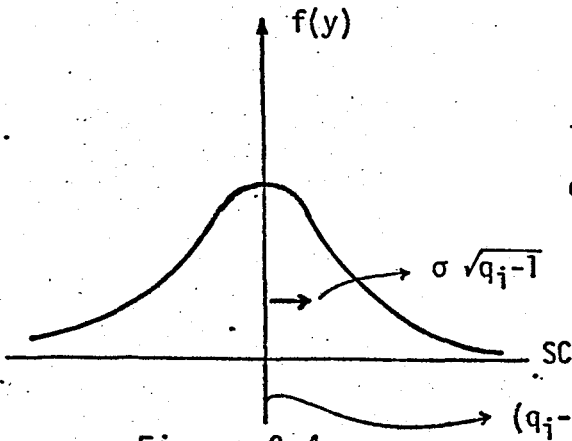
If we use notations x and y for the demand distributions of first period $[t_i, 0]$ and second period $[1, q-1]$ respectively we will see that $(\sigma_{x+y}^2 = \sigma_x^2 + \sigma_y^2)$ variance of the demand over the whole period $t_i, q-1$ is equal to the sum of the variances of the first and second periods.



$f(x)$ shows the demand distribution of first period

Figure 2.3

$(t_i + 1) R_i$



$f(y)$ shows the demand distribution of second period

Figure 2.4

$$E(x) \leq (t_i + 1) R_i$$

$$E(y) = (q_i - 1) R_i$$

$$\sigma^2(x) > 0$$

$$\sigma^2(y) = (q_i - 1) \sigma^2$$

$$\sigma^2_{x+y} = \sigma^2(x) + \sigma^2(y)$$

because

$$P(xy) = P(x) \cdot P(y)$$

(x and y are independent variables)

Instead of $f(x)$, using the expected value of x, which is equal to a constant ($SC_i - e_i$) decreases the whole period variance.

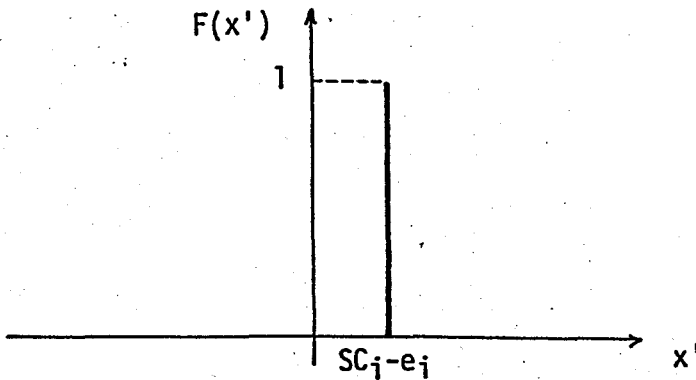


Figure 2.5

$$\sigma^2(x') = \sigma^2(\text{constant}) = \sigma^2(SC - e_i) = 0$$

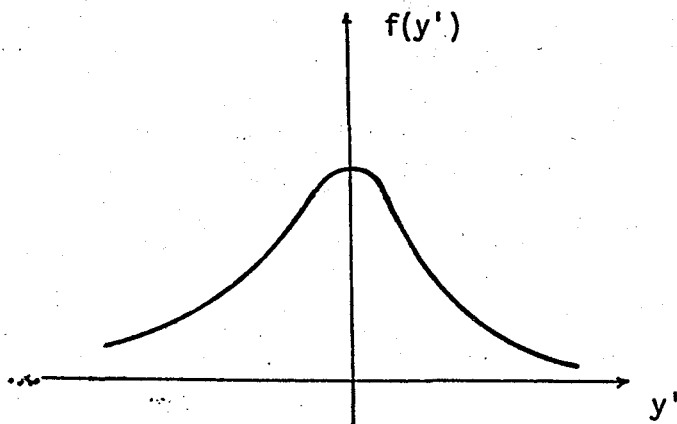


Figure 2.6

$$\sigma^2(y') = \sigma^2(y) = (q_i - 1) \sigma^2$$

$$\sigma^2_{x'+y'} = \sigma^2_{x'} + \sigma^2_{y'} \quad \text{where} \quad \sigma^2_{x'} = 0$$

and

$$\sigma^2_{y'} = \sigma^2_y$$

then

$$\sigma^2_{x'+y'} = \sigma^2_{y'} = \sigma^2(y)$$

$$\sigma^2_{x+y} = \sigma^2(x) + \sigma^2(y) \geq \sigma^2(y)$$

because $\sigma^2(x) \geq 0$

So $\sigma^2_{x'+y'} \leq \sigma^2_{x+y}$

Relation between table and real values does not possess the characteristics of the relation between two normal curves with same means and different variances. First we take two normal curves with same means and different variances. We can easily say that both of them are symmetric and therefore the difference of the two symmetric curves around mean is

also symmetric. The difference of the two symmetric curves around mean will be symmetric (Figure 2.2). Then we take our real distribution curve, which is the summation of the conditional first part with the normally distributed second part. Conditional first part is non-symmetric but normally distributed second part is symmetric. Summation of one symmetric and one non-symmetric distribution will give us a non-symmetric distribution. So our real values graphs a non-symmetric curve. But when we look at our table values we see that they are normally distributed with $E(x+y) = E(x) + E(y)$ and $\sigma_{x+y}^2 = \sigma_y^2$ in other words it is a symmetric curve. Then the difference of the non-symmetric real values and symmetric table values around mean will also be non-symmetric. The difference of the symmetric and non-symmetric curves will be non-symmetric (Figure 1.2a).

The practical conclusion is that; using table values will be underestimating the real variance, unfortunately, we can not solve the problem only by increasing the variance. Increasing the variance will change its shape symmetrically but symmetric changes won't yield acceptable solution to our problem.

2.2 Elimination of Parameters

So far we deal with 5 parameters t_i , q_i , σ_i^2 , R_i and SC_i . From now on we will use $PER1_i$ instead of t_{i+1} , $PER2_i$ instead of q_{i-1} . $PER1_i$ defines the number of days of the planning horizon which we are trying to find the stockout probability. Dividing the other three terms (σ_i , R_i , SC_i) by R_i we get $\sigma_i'^2 = \sigma_i^2/R_i^2$, $R_i' = R_i/R_i = 1$ and $SC_i' = SC_i/R_i$ and this helps us to eliminate R_i parameter from our analysis.

We know that probability of stockout for given n days at a given SC_i is equal to $1 - F(Z)$, where Z can be found from the following equation.

$$Z = \frac{X - E(X)}{\sigma_x} \quad E(X) = n R_i$$

$$\sigma_x = \sqrt{n} \sigma$$

Therefore

$$Z = \frac{X - n R_i}{\sigma \sqrt{n}} = \frac{R_i \left(\frac{X}{R_i} - n \right)}{R_i \left(\frac{\sqrt{n} \sigma}{R_i} \right)} = \frac{\frac{X}{R_i} - n}{\frac{\sigma \sqrt{n}}{R_i}}$$

This is equivalent to using random variable Y to measure demand in units of expected daily demand for given n days.

$$Y_i = \frac{X_i}{R_i} \quad E[Y_i] = \frac{E[X_i]}{R_i} = n$$

$$\sigma |Y_i| = \frac{\sigma [X_i]}{R_i} = \frac{\sqrt{n} \sigma}{R_i}$$

By the help of this analyses we eliminate the variable R_i , and assume that daily demand for each day is distributed normally for each node with a mean 1.

2.3 P1P2T

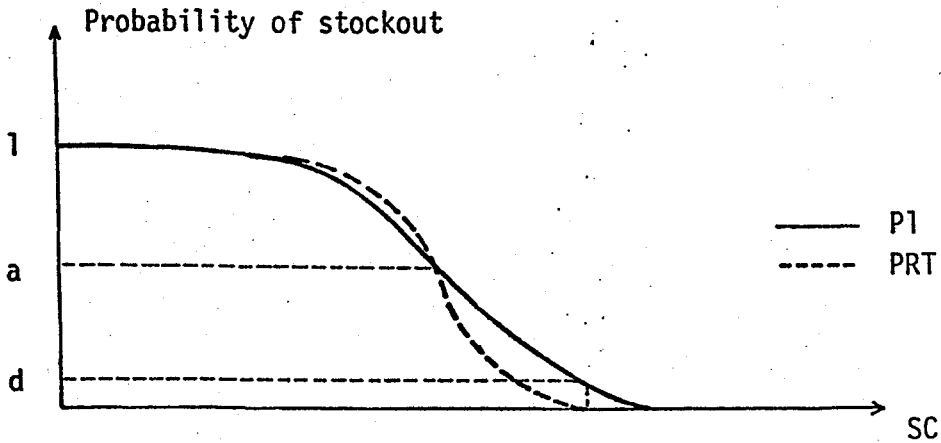
Now we define a new parameter P1P2T which will be used to measure the error percentage.

$$P1P2T = \left[\frac{P1 - PRT \pm \epsilon}{P1 \pm \epsilon} \right]$$

$\epsilon \rightarrow 0$

$P1$ is the real probability and PRT is the table approximation probability.

In the light of the previous figure (Figure 1.1)



we will get the following scheme

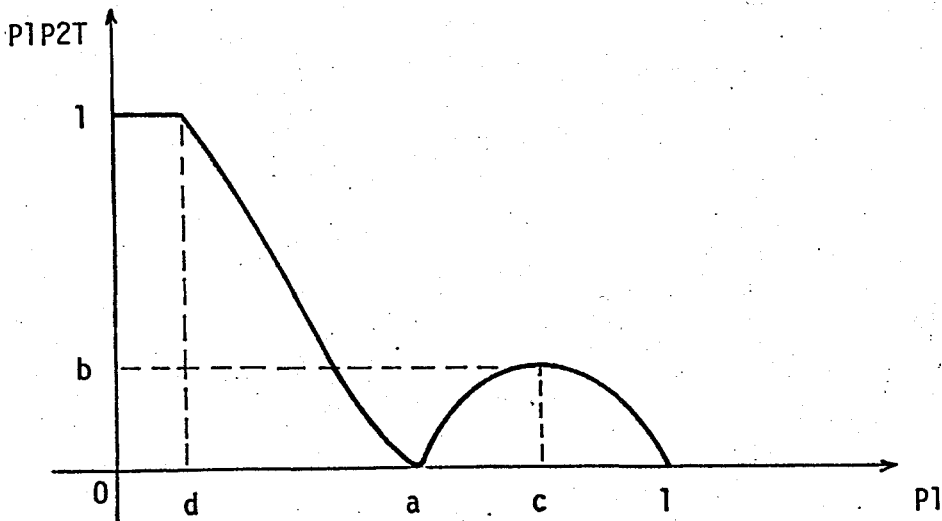


Figure 2.7

$$P1P2T = \left[\frac{P1 - PRT \pm \epsilon}{P1 \pm \epsilon} \right] \text{ where } \epsilon \text{ is a very small number.}$$

We can divide Figure 2.7 into 3 regions.

$$1) \quad 0 \leq P1 \leq d$$

When P1 is equal to zero, PRT must be zero also. PRT value starts to increase after P1 reaches a considerable value. So when PRT is equal to zero, then

$$P1P2T = \left[\frac{P1 \pm \epsilon}{P1 \pm \epsilon} \right] = 1$$

$$PRT=0$$

$$2) \quad d \leq P1 \leq a$$

When PRT value starts to increase, P1P2T value decreases, the reasons for this decrease are: i. Since PRT value increases faster than P1 value (P1 - PRT) value decreases. (PRT curve has a smaller variance than P1 curve.) This decreases the numerator part of P1P2T.

ii. P1 value increase and this increases the denominator part. Increase in denominator together with decrease in the numerator continues to the point where P1 curve intercepts with the PRT curve. This is the point where P1 equals to "a" and P1P2T equals to zero

$$P1P2T = \left[\frac{P1 - P1 \pm \epsilon}{P1 \pm \epsilon} \right] = 0$$

$$\epsilon \rightarrow 0$$

$$PRT \rightarrow P1$$

$$3) \quad a \leq P1 \leq 1$$

After this interception point P1P2T curve shows the characteristics of 2nd degree polynomial. First, it increases and after reaching maximum point (let us define coordinates of this point by P1 = c and P1P2T = b) it begins to decrease until P1 = 1 where P1P2T reaches to value zero.

$$P1P2T = \left[\frac{P1 - 1 \pm \epsilon}{P1 \pm \epsilon} \right] = 0$$

Note: PRT curve reaches one before P1 curve.

We can see from Figure 2.7 that especially for small stockout probability values the error percentage is very high. Increase in PER1 value will have a direct effect on the variance of our P1 curve and this will increase the difference between our curves, in other words an increase of error will be observed. These statements are correct when PER2 is constant. Increase in PER2 will lead to variance increases for both curves and probably this will decrease the difference between them. As we can conclude from here PER1/PER2 value is more effective on the system as compared to PER1 and PER2 values individually.

Error percentage will increase if we increase $\frac{PER1}{PER2}$ value. We can also say that $\frac{PER1}{PER2}$ value is one of the most important factors of P1P2T function.

Variance of daily demand is important for our system. Comparing extreme cases for variance will show us the effect of variance on the P1P2T curve. If daily demand variance is very small, then 1st part variance is equal to a very small number also, and this means that P1 curve has a very small variance like PRT curve. (The difference between two small variances (P1 and PRT) is very small so $P1P2T \rightarrow 0$.) But if we increase the daily demand variance P1P2T value increases or in another words P1P2T curve shifts upwards (increasing error).

Variance is an effective factor of our P1P2T curve, but it is more meaningful to take $PER1/\sigma^2$ as a factor as a factor

and not σ^2 by itself. Because instead of dealing with effect of variables alone it is more realistic to analyze the effect of ratios. So we take $PER1/\sigma^2$ as one of our parameters. When we think of the effect of this ratio, it will be observed that increasing this ratio will decrease our P1P2T value. Taking $PER1$ constant and decreasing variance, or taking variance constant and increasing $PER1$ value forces our $(1-F(x))$ curve to have a narrower shape.

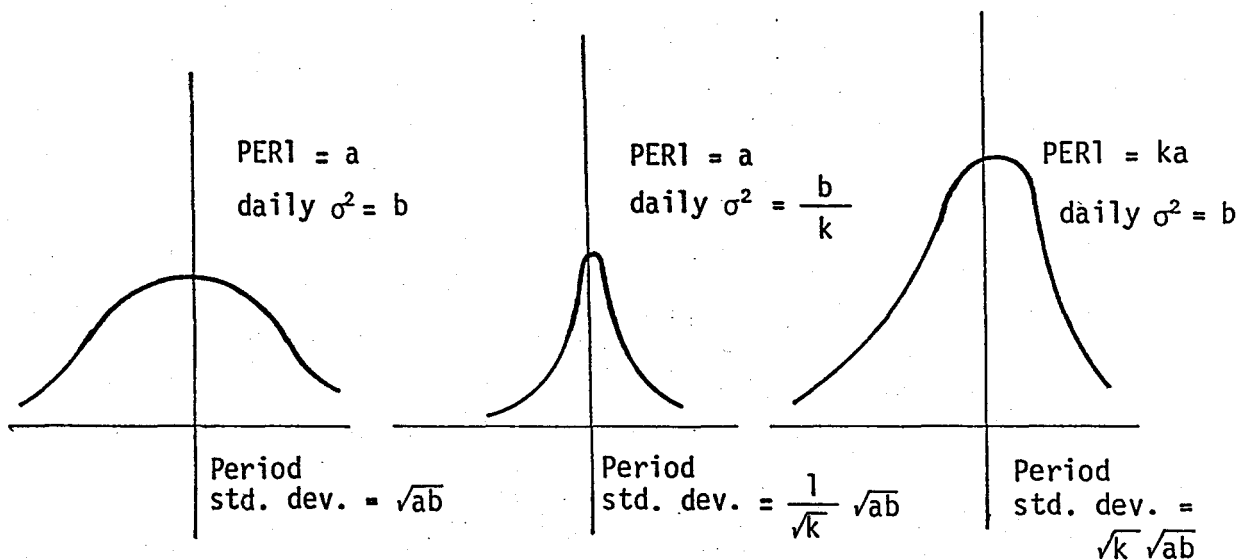


Figure 2.8a

Figure 2.8b

Figure 2.8c

$$Z_1 = \frac{X - a}{\sqrt{ab}}$$

$$Z_2 = \frac{X - a}{\frac{1}{\sqrt{k}} \sqrt{ab}}$$

$$Z_3 = \frac{kX - ka}{\sqrt{k} \sqrt{ab}}$$

$$Z_3 = \frac{\sqrt{k} (X - a)}{\sqrt{ab}}$$

$$Z_2 = Z_3$$

Z_2 and Z_3 values are greater than Z_1 , and since Z_i value ($i = 1, \dots, n$) is the only factor which determines the shape of the curve (Figure 10a,b,c) (increase in Z_i makes the $(1-F(x))$ curve narrower) or P1P2T curve (Scheme 9) will shift downwards.

A question may come to our mind such that eventhough we increase PER1 value how does the curve $(1 - F(x))$, Figure 1) becomes narrower. Since we know that increase in PER1 will lead us to an increase at the variance of 1st part of the curve. We can easily answer that we are not dealing with PER1 value only by itself but we are concerned with the $PER1/\sigma^2$ ratio effect. PER1 increase will lead us to an increase in P1P2T value but we take it into consideration by making one of the variables equal to $\frac{PER1}{PER2}$ value. Effect of the increase in PER1 value can be shown at this part of the equation.

We will now define the most important parameter EII which shows us the percentage expected stockout. Equation for that is:

$$EII = \frac{PER2 - EI}{EI}$$

If we subtract the expected inventory at the beginning of period 2 from expected demand over period 2, we will get an expected negative inventory at the end of the period.

$$E(I_q^-) = E\left(\sum_{r=1}^{q-1} \xi_r\right) - EI \quad E(I_q^-) = \text{Expected negative inventory at the end of period}$$

$$= PER2 - EI$$

EI = Expected inventory at the beginning of period

If negative inventory value is greater than zero, we expect a stockout over that period with a probability approximately greater than %50, and otherwise we expect a probability approximately less than %50.

So increase in negative inventory comes together with an increase in stockout probability. Division of I_q^- by the EI gives us the expected negative inventory percentage.

$EII = \frac{I_q^-}{EI}$ and this ratio is more meaningful than I_q^- when we deal to find a variable in order to express the characteristics of PIP2T curve.

Example 2: Let us compare 2 situations:

2.i) $EI_1 = 3$

$PER2_1 = 4$

$$EII_1 = \frac{4 - 3}{3} = \frac{1}{3}$$

2.ii) $EI_2 = 103$

$PER2_2 = 104$

$$EII_2 = \frac{104 - 103}{103} = \frac{1}{103}$$

If EII is positive, although I_q^- 's are equal, first point will tell us a very high stockout probability when it is compared with the second one. Second one (if denominator is very large) will give us nearly %50 probability.

If $EII < 0$, second point will give us higher stockout probability than the first one. We can think EII as Z value in normality table and EI as σ^2 value. Increasing EI is similar to increasing variance.

What we have said for I_q^- is true also for an increase in stockout probability.

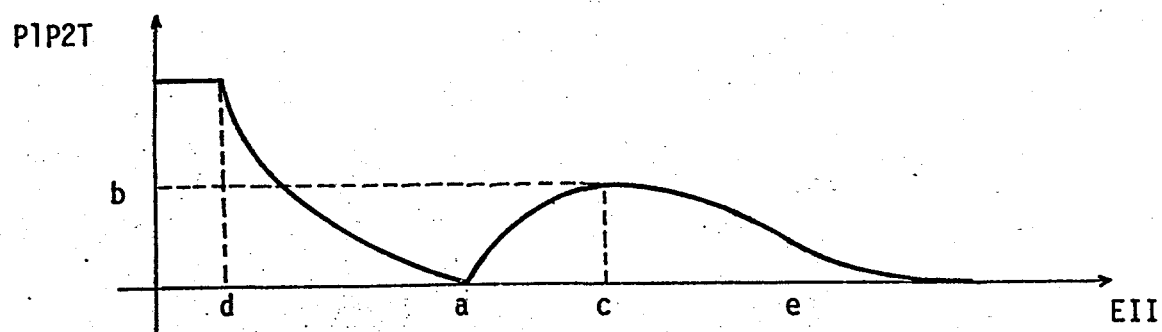


Figure 2.9

$$P1P2T = \left[\frac{P1 - PRT \pm \epsilon}{P1 \pm \epsilon} \right]$$

$$EII = \frac{PER2 - EI}{EI}$$

There exists 4 regions.

i) When EII is between $-\infty$ and "d" value PRT equals zero.

$$-\infty < \frac{PER2 - EI}{EI} < d$$

$$P1P2T = \left[\frac{P1 - 0 \pm \epsilon}{P1 \pm \epsilon} \right] = 1$$

$$PRT = 0$$

ii) When EII is between d and a P1P2T shows a decreasing characteristic.

$$d \leq \frac{PER2 - EI}{EI} \leq a$$

$$\frac{\partial P1P2T}{\partial EII} \leq 0$$

When EII is equal to "a", P1P2T equals to zero
(P1 equals to PRT at that point)b

$$EII = a, P1 = PRT, P1P2T = \left[\frac{P1 - P1 \pm \epsilon}{P1 \pm \epsilon} \right] = 0$$

$$PRT \rightarrow P1$$

iii) When EII is between "a" and "e" P1P2T shows the characteristics of second degree polynomial.

$$a \leq \frac{PER2 - EI}{EI} \leq c$$

$$\frac{\partial P1P2T}{\partial EII} > 0$$

$$\frac{PER2 - EI}{EI} = c$$

$$\frac{\partial P1P2T}{\partial EII} = 0 \text{ and also } P1P2T = b$$

$$c < \frac{PER2 - EI}{EI} < e$$

$$\frac{\partial P1P2T}{\partial EII} < 0$$

iv) When EII is greater or equal to e , $P1P2T$ is equal to zero.

$$\frac{PER2 - EI}{EI} \geq e \quad \frac{\partial P1P2T}{\partial EII} = 0 \quad P1P2T = \left[\frac{1 - 1 \pm \epsilon}{1 \pm \epsilon} \right] = 0$$

$P2 \rightarrow 1$
 $PRT \rightarrow 1$

P1DP2T

Now we define $P1DP2T$ which is an other form of function $P1P2T$.

$$P1DP2T = \frac{P1 \pm \epsilon}{PRT \pm \epsilon} \quad P1P2T = \left[\frac{P1 - PRT \pm \epsilon}{P1 \pm \epsilon} \right]$$

$$P1P2T = \begin{cases} 1 - \frac{PRT}{P1 \pm \epsilon} & P1 \geq PRT \\ \frac{PRT}{P1 \pm \epsilon} - 1 & P1 < PRT \end{cases}$$

2.4 P1DP2T

We interpret $P1P2T$ as an error measuring function and it helps us to observe the high percentage error regions but because of its absolute character, we prefer to use $P1DP2T$ function from now on.

$$\text{If } P1 \geq PRT \quad P1P2T = \frac{P1 - PRT}{P1} \quad P1DP2T = \frac{P1}{PRT} = \frac{1}{1 - P1P2T}$$

$$\text{If } P1 < PRT \quad P1P2T = \frac{PRT - P1}{P1} \quad P1DP2T = \frac{P1}{PRT} = \frac{1}{P1P2T + 1}$$

$$P1DP2T = \begin{cases} \frac{1}{1 - P1P2T} & P1 \geq PRT \\ \frac{1}{1 + P1P2T} & P1 < PRT \end{cases}$$

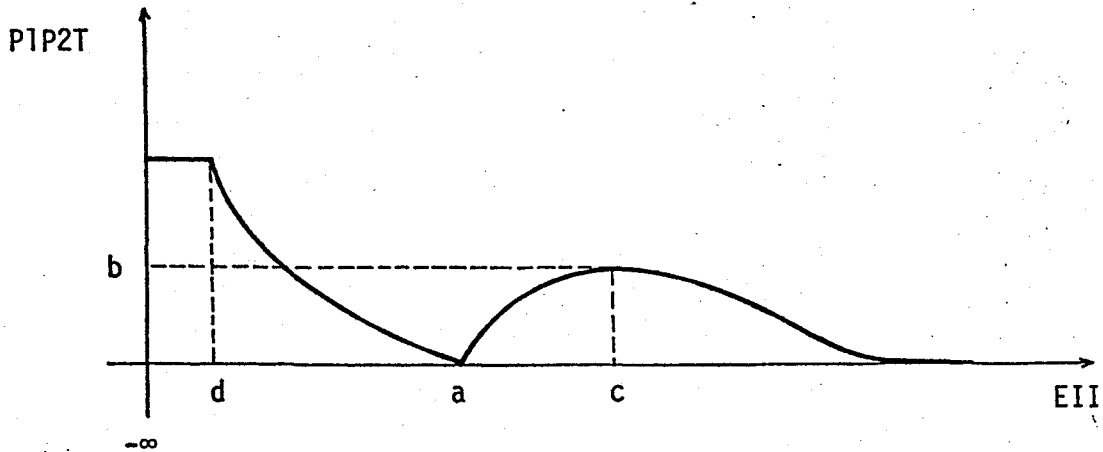


Figure 2.9

We try to plot $P1DP2T$ versus EII .

$$i) \quad -\infty \leq EII \leq d \quad P1DP2T = \frac{1}{1 - P1P2T} = \frac{1}{1-1} = \infty$$

$$ii) \quad d \leq EII \leq a \quad \frac{\partial P1DP2T}{\partial EII} \leq 0$$

because $P1P2T$ is a decreasing function between these EII limits, then $1 - P1P2T$ must be increasing and $\frac{1}{1 - P1P2T}$ must be decreasing function.

$$iii) \quad a \leq EII \leq c \quad \frac{\partial P1DP2T}{\partial EII} \leq 0 \quad \text{at } EII = a \quad P1 = PRT$$

Because $P1P2T$ is an increasing function, $1 + P1P2T$ must also be an increasing function and $\frac{1}{1 + P1P2T}$ must be decreasing function.

$$\text{iv) } c \leq \text{EII} \quad \frac{\partial \text{PIDP2T}}{\partial \text{EII}} \geq 0$$

Because PIDP2T must be decreasing function, $1 \pm \text{PIDP2T}$ must be decreasing and $\frac{1}{1 + \text{PIDP2T}}$ must be increasing function.

$$\text{v) } \lim_{\text{EII} \rightarrow \infty} \text{PIDP2T} \rightarrow 1$$

When we plot PIDP2T versus EII a curve with special characteristics can be seen.

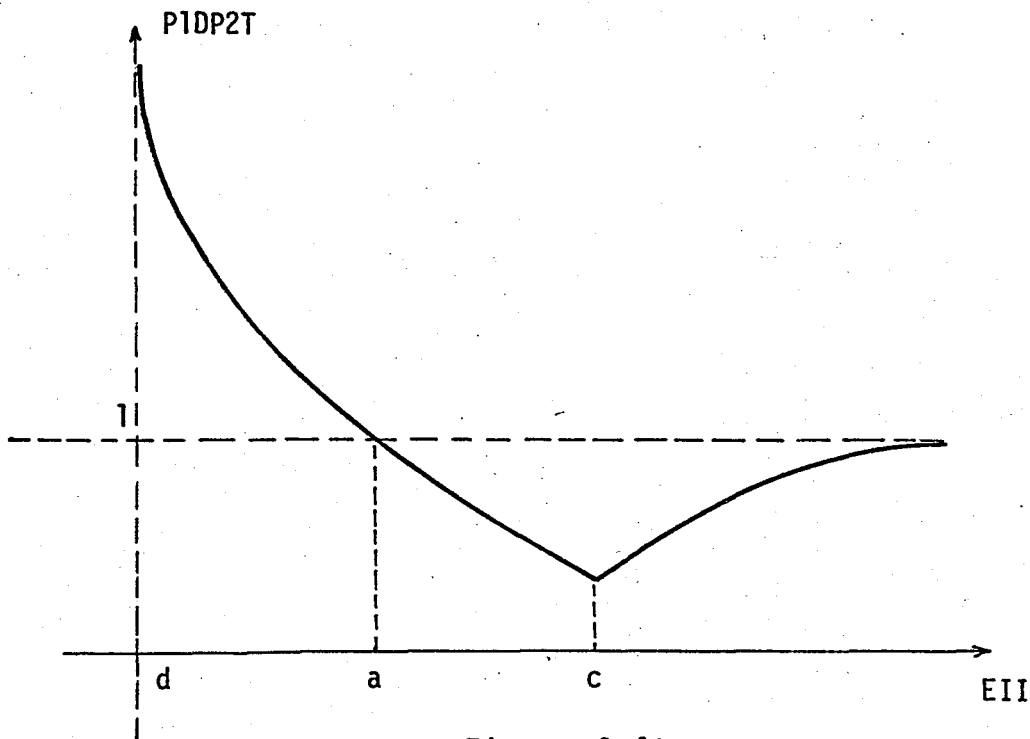


Figure 2.10

From now on we will focus our attention only on this figure. First we will collect data by a simulation program and then using regression methods we will estimate critical points, in terms of the parameters which we mentioned before. Then by using table values and PIDP2T function, which we obtained from

regression analysis, we will make another estimation for stockout probabilities (we call it P1EST).

$$P1EST = (PRT) \times (P1DP2T)$$

Instead of PRT values, P1EST values will be used in Inventory Routing Problem. It will affect our results especially for problems with given high stockout costs or high daily variances.

III. SIMULATION

In previous chapters, we mentioned the characteristics of the system. Next, through a simulation model we will generate some quantitative results.

3.1 Real Probability Value

We defined in introduction part the stockout probability as;

$$P_{i,q} = P \left\{ \sum_{r=t_j}^{q-1} \xi_r^i > SC_i / \sum_{r=t_j}^0 \xi_r^i \leq SC_i \right\}$$

Then we changed it into

$$P_{i,PER2} = P \left\{ \sum_{r=-(PER1+1)}^{PER2} \xi_r^i > SC_i / \sum_{r=-(PER1+1)}^0 \xi_r^i \leq SC_i \right\}$$

The daily requirements ξ_q^i of demand node i in day q are independent and identically distributed random variables with expected values equaling to one (mean = 1 = $E[\xi_q^i]$) and variances $\sigma_{iq}^2 = q\sigma_i^2$. Therefore instead of dealing with daily demands we prefer to deal with the periodic demands. Next, we

use simulation technique and generate demand random variables for the first and second periods.

Library random number generator of CDC which generates normally distributed random numbers with zero mean and unit variance, is used for this purpose. This is a generator which gives us the deviation from mean value. So we will adjust the outcomes by multiplying them with the standard deviation of our periodic demand to obtain normally distributed random variables with our desired mean and variance.

If Y is a normally distributed random variable with mean and standard deviation .

$$\text{Then } X = \frac{Y - \mu}{\sigma}$$

where X is normally distributed random variable with mean 0 and standard deviation 1.

$$\rightarrow Y = \mu + \sigma X$$

$$\text{In our case } Y = \text{PER}_i + \sigma \sqrt{\text{PER}_i} X$$

$$(\mu = \text{PER}_i, \sigma_{\text{period}} = \sigma_{\text{day}} \sqrt{\text{PER}_i})$$

So we can generate periodic demands by a random number generator through normally distributed random variables with unit variance and zero mean. At this point a new problem arises; some generated quantities may be negative. This will happen when

$$Y = \text{PER}_i + X \sigma \sqrt{\text{PER}_i} \leq 0$$

$$\rightarrow X \leq -\frac{\sqrt{\text{PER}i}}{\sigma}$$

All we can say is that increase in PERi or decrease in daily variance, increases the probability of Y to be greater than zero.

$$P\{Y < 0\} = \phi\left(\frac{-\sqrt{\text{PER}i}}{\sigma}\right)$$

What can we do, when we generate negative values? It is meaningless to accept negative value of demand over some period. We have 2 alternatives. First one is not taking it into account and generating a new one. The second alternative is assuming negative value as a zero demand. Following figures compare two alternatives.

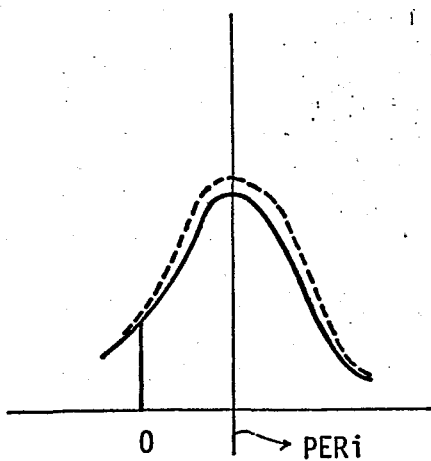


Figure 3.1a

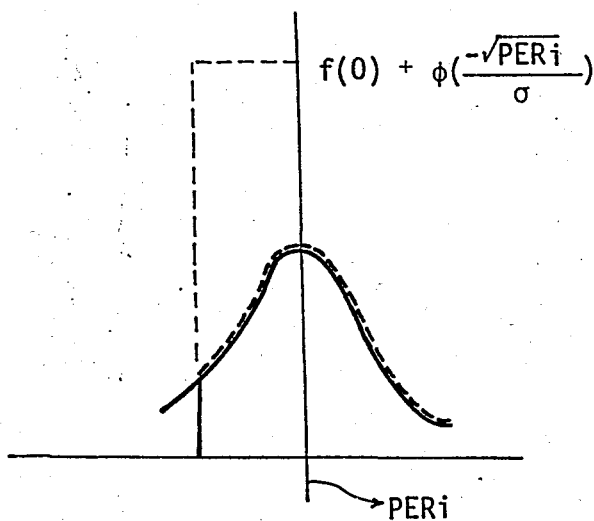


Figure 3.1b

First decision rule shifts the curve upwards by putting a conditional part. There is no such shift for the second one. Expected values increases for both of the situations but increase in the first one must be greater than the other. Our

conclusion is, since second one increases our mean value less than the first one, it is more appropriate to use second decision rule in our analyses. So, when we generate a negative value, we assume zero demand occurring over that period.

The shape of our normal curve deteriorates for small values of PER_i and large values of variance and we can say that dealing with periodic demand instead of daily demand decreases the deterioration of the normal curve.

We generate two numbers which we will use as periodic demand for PER_1 and PER_2 . But for the first period demand we know it will be less or equal than storage capacity, which means that we won't use the generated Y value if it is greater than SC value. We generate a second one if first value is less than or equal to storage capacity, and then by adding the two values and comparing with storage capacity we decide if stockout occurred at that trial. We repeat this many times and dividing the number of trials in which stockout occurred, to the total number of trials we get stockout probability for given PER_1 , PER_2 , σ^2 and SC values.

$$P\{\text{Stockout}\} = \frac{\text{No of trials in which stockout occurred}}{\text{Total no of trials}}$$

Increasing the total number of trials will give us a better estimation for stockout probability, but it also requires a larger computer time. We can determine the appropriate trial number which will give us a good estimation together with an economic usage of computer time by experimenting. We repeat this procedure for different values of PER_1 , PER_2 , σ^2 and SC .

By taking PER1, PER2 and σ^2 constant and by changing SC value we develop a system which uses the same random number with different SC values. Let us say that we try to estimate P1 for given PER1, PER2 and σ^2 values and SC from SCMIN to SCMAX in k increments.

First we generate two random numbers X_1 and X_2 . Then we convert them to Y_1 and Y_2 where $Y_1 = \text{PER1} + X_1 \sigma / \text{PER1}$ and $Y_2 = \text{PER1} + X_1 \sigma / \text{PER2}$. We compare Y_1 value with SC_j , if Y_1 is greater; then we don't use this pair of random numbers in the estimation of P1 for that given SC_j , but if Y_1 is smaller we then add Y_1 and Y_2 up, and use it in our estimation, by comparing the sum with SC_j . Instead of comparing Y_1 and $Y_1 + Y_2$ with all SC_j ($j = 1, \dots, k$) values, we use a boundary approach. We rank SC_j values in an increasing order such that $SC_1 \leq SC_2 \leq \dots \leq SC_k$. First we define II_j , $j = 1, 2, \dots, k$ which gives us the total number of trials that we use in simulation for given storage capacity SC_j . Define II_j , $j = 1, 2, \dots, k$ number of trials in which stockout occurs for given storage capacity SC_j . Then we try to find "t" value which satisfies the following condition:

$$SC_{t-1} \leq Y_1 \text{ (or } Y_1 + Y_2) \leq SC_t$$

where $SC_0 = 0$ and $SC_{k+1} = L$ (very large number)

First, we find boundary t for random number Y_1 , and increment II_j by one where j goes from "t" to "k". ($j = t, t+1, \dots, k$). This means that we increase total trial number by one, where Y_1 is less than our storage capacity. And store this "t" value as tt. Then we find boundary "t" for random

number $Y_1 + Y_2$ and increment 11_j by one where j goes from tt to $t-1$, ($j = tt, \dots, t-1$).

These are the cases where the storage capacities are greater than Y but also less than $Y_1 + Y_2$ (In our problem this is the region where we satisfy demand till time zero but we don't satisfy demand between time zero and $PER2$, in other words, stockout region.)

3.2 Table Probability Value

Probability of a stockout during the planning horizon $PER2$, can be expressed as following.

$$P\left\{ \sum_{r=t_i}^{q-1} \xi_r^i > SC_i / \sum_{r=t_i}^0 \xi_r^i \leq SC_i \right\} \quad \text{or}$$

$$P\left\{ \sum_{r=-PER1+1}^{PER2} \xi_r^i > SC_i / \sum_{r=-PER1+1}^0 \xi_r^i \leq SC_i \right\}$$

And by using the derivations in the introduction part we get;

$$P_{i,PER2} = 1 - \phi_i^{PER2}[e_i] \quad \text{and} \quad e_i = \frac{\sum_{u=0}^{SC_i-1} \phi_i^{PER1}(u)}{\phi_i^{PER1}(SC_i)}$$

where P_i is the stockout probability over $PER2$ days (includes the day $PER2$), and it is very easy to calculate $P_{i,PER2}$ by using z table.

3.3 P1DP2T

We have PRT and P1 values in our hand. Dividing P1 values to PRT values, we can obtain P1DP2T values, we can obtain P1DP2T values. Plotting the simulation result gives us the following figure (Figure 3.2).

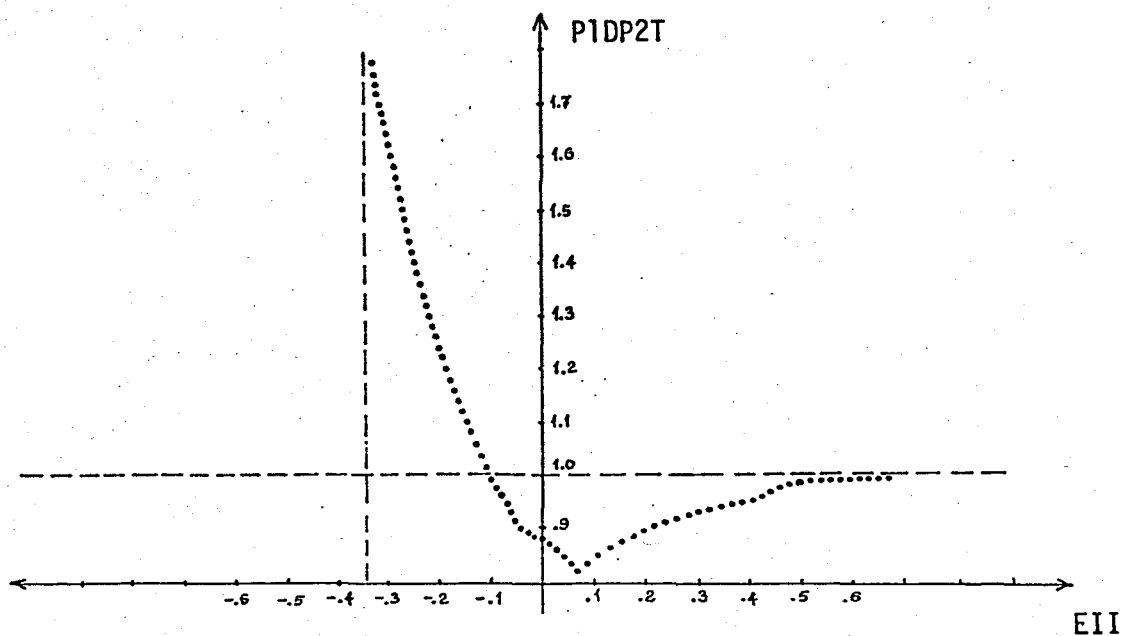


Figure 3.2

Since EII is the most effective variable, we focus our attention on the curve where P1DP2T versus EII is plotted. Drawing this curve for different values of other variables $(\frac{PER1}{PER2}, \frac{PER1}{\sigma^2})$ we observe that there exists a point at which the shape of the curve changes. Curve shows different characteristics before and after this critical point.

The critical point moves when we change PER1, PER2 and σ^2 values. So we try to express the coordinates of the critical point in terms of the variables $\frac{PER1}{PER2}$ and $\frac{PER1}{\sigma^2}$.

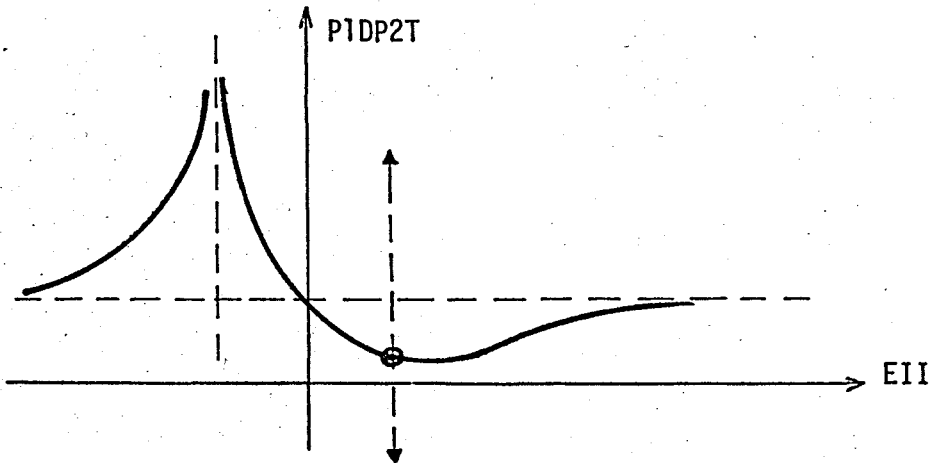


Figure 3.3

$$EII_{cr} = f(\text{PER1/PER2}, \text{PER1}/\sigma^2)$$

$$P1DP2T_{cr} = f(\text{PER1/PER2}, \text{PER1}/\sigma^2)$$

First we assume a simple linear relationship

$$EII_{cr_1} = a \left(\frac{\text{PER1}}{\text{PER2}} \right) + b \left(\frac{\text{PER1}}{\sigma^2} \right) + c$$

$$P1D_{cr} = d \left(\frac{\text{PER1}}{\text{PER2}} \right) + e \left(\frac{\text{PER1}}{\sigma^2} \right) + f$$

We deal with the experimentation part as follows:

We take PER1, PER2 and σ^2 constant and change SC values, this will give us different EII values (EII is a function of EI and EI is a function of SC).

We can find P1DP2T values which corresponds directly to our EII values. (We know that $P1DP2T(EII) = \frac{PI(EII)}{PRT(EII)}$.) We can easily observe where P1DP2T value reaches minimum point and note the coordinates of this point as P1DCR and EIICR₁.

The following data points can be seen at the Appendix 1.

Example 3 : PER1 = 12 PER2 = 12 $\sigma^2 = 1$

<u>SC</u>	<u>EII</u>	<u>EI</u>	<u>PI</u>	<u>PIP2T</u>	<u>PIDP2T</u>	<u>PRT</u>
⋮						
21.5	.3285	9.0328	.6955	.1536	.8667	.8023
21.75	.2934	9.2776	.6771	.1554	.8654	.7823
22.0	.2602	9.5221	.6558	.1606	.8615	.7611
22.25	.2286	9.7672	.6359	.1619	.8605	.7389
22.5	.1984	10.0137	.6197	.1549	.8657	.7157
22.75	.1693	10.2622	.6025	.1477	.8712	.6915

We take PIDCR = .8605 EIICR₁ = .2286 when PER1 = 12, PER2 = 12 and $\sigma^2 = 1$. We make this analyses for different values of σ^2 , PER1, PER2. We put limits on the range of our variables for the purpose of a specific problem.

Limits are chosen such as

- i) PER1 \leq 20
- ii) PER2 \leq 20
- iii) .3 \leq σ^2 \leq 2

Choosing a large range for parameters, results in lack of fit. We will make suggestions for further research on this topic in the last chapter.

We use a least square approximation technique to estimate a,b,c,d,e and f values. Defining X to $\frac{PER1}{PER2}$, Y to $\frac{PER1}{\sigma^2}$, Z₁ to EIICR₁ and Z₂ to PIDP2T, we get following equations.

$$Z_1 = \hat{a}X + \hat{b}Y + \hat{c}$$

$$Z_2 = \hat{d}X + \hat{e}Y + \hat{f}$$

$$\text{SSE (Sum of square of error)} = \sum_{i=1}^n (Z_{1i} - \hat{a}X_i - \hat{b}Y_i - \hat{c})^2$$

$$\frac{\partial \text{SSE}}{\partial \hat{a}} = -2 \sum_{i=1}^n (Z_{1i} - \hat{a}X_i - \hat{b}Y_i - \hat{c})(X_i) = 0$$

$$\frac{\partial \text{SSE}}{\partial \hat{b}} = -2 \sum_{i=1}^n (Z_{1i} - \hat{a}X_i - \hat{b}Y_i - \hat{c})(Y_i) = 0$$

$$\frac{\partial \text{SSE}}{\partial \hat{c}} = -2 \sum_{i=1}^n (Z_{1i} - \hat{a}X_i - \hat{b}Y_i - \hat{c}) = 0$$

We get the following equations

$$\sum_{i=1}^n Z_{1i} X_i = \hat{a} \sum_{i=1}^n X_i^2 + \hat{b} \sum_{i=1}^n X_i Y_i + \hat{c} \sum_{i=1}^n X_i$$

$$\sum_{i=1}^n Z_{1i} Y_i = \hat{a} \sum_{i=1}^n X_i Y_i + \hat{b} \sum_{i=1}^n Y_i^2 + \hat{c} \sum_{i=1}^n Y_i$$

$$\sum_{i=1}^n Z_{1i} = \hat{a} \sum_{i=1}^n X_i + \hat{b} \sum_{i=1}^n Y_i + n \hat{c}$$

Applying what we mention above, we first estimate a,b,c, d,e and f values, then we understand that we come to face with a lack of fit. This means that $Z_1 = \hat{a}X + \hat{b}Y + \hat{c}$ equation is inadequate for our data points. By trial and error we find an equation which fits with our data points. (Appendix 2 includes linear regression result.)

$$Z_1 = aX + \frac{b}{X} + cY + d \frac{Y}{X} + e$$

$$TSE = \sum_{i=1}^n (Z_{1i} - aX_i - \frac{\hat{b}}{X_i} - cY_i - \hat{d} \frac{Y_i}{X_i} - e)^2$$

$$\frac{\partial TSE}{\partial \hat{a}} = -2 \sum_{i=1}^n (Z_{1i} - aX_i - \frac{\hat{b}}{X_i} - cY_i - \hat{d} \frac{Y_i}{X_i} - e)(X_i) = 0$$

$$\frac{\partial TSE}{\partial \hat{b}} = -2 \sum_{i=1}^n (Z_{1i} - aX_i - \frac{\hat{b}}{X_i} - cY_i - \hat{d} \frac{Y_i}{X_i} - e)(\frac{1}{X_i}) = 0$$

$$\frac{\partial TSE}{\partial \hat{c}} = -2 \sum_{i=1}^n (Z_{1i} - aX_i - \frac{\hat{b}}{X_i} - cY_i - \hat{d} \frac{Y_i}{X_i} - e)(Y_i) = 0$$

$$\frac{\partial TSE}{\partial \hat{d}} = -2 \sum_{i=1}^n (Z_{1i} - aX_i - \frac{\hat{b}}{X_i} - cY_i - \hat{d} \frac{Y_i}{X_i} - e)(\frac{Y_i}{X_i}) = 0$$

$$\frac{\partial TSE}{\partial \hat{e}} = -2 \sum_{i=1}^n (Z_{1i} - aX_i - \frac{\hat{b}}{X_i} - cY_i - \hat{d} \frac{Y_i}{X_i} - e) = 0$$

And we get following equations.

$$\sum_{i=1}^n Z_{1i} X_i = \hat{a} \sum_{i=1}^n X_i^2 + \hat{b} \cdot n + \hat{c} \sum_{i=1}^n Y_i X_i + \hat{d} \sum_{i=1}^n Y_i + \hat{e} \sum_{i=1}^n X_i$$

$$\sum_{i=1}^n \frac{Z_{1i}}{X_i} = \hat{a} \cdot n + \hat{b} \sum_{i=1}^n \frac{1}{X_i^2} + \hat{c} \sum_{i=1}^n \frac{Y_i}{X_i} + \hat{d} \sum_{i=1}^n \frac{Y_i}{X_i^2} + \hat{e} \sum_{i=1}^n \frac{1}{X_i}$$

$$\sum_{i=1}^n Z_{1i} Y_i = \hat{a} \sum_{i=1}^n X_i Y_i + \hat{b} \sum_{i=1}^n \frac{Y_i}{X_i} + \hat{c} \sum_{i=1}^n Y_i^2 + \hat{d} \sum_{i=1}^n \frac{Y_i^2}{X_i} + \hat{e} \sum_{i=1}^n Y_i$$

$$\sum_{i=1}^n Z_{1i} \frac{Y_i}{X_i} = \hat{a} \sum_{i=1}^n Y_i + \hat{b} \sum_{i=1}^n \frac{Y_i}{X_i^2} + \hat{c} \sum_{i=1}^n \frac{Y_i^2}{X_i} + \hat{d} \sum_{i=1}^n \frac{Y_i^2}{X_i^2} + \hat{e} \sum_{i=1}^n \frac{Y_i}{X_i}$$

$$\sum_{i=1}^n Z_{1i} = \hat{a} \sum_{i=1}^n X_i + \hat{b} \sum_{i=1}^n \frac{1}{X_i} + \hat{c} \sum_{i=1}^n Y_i + \hat{d} \sum_{i=1}^n \frac{Y_i}{X_i} + \hat{e} \cdot n$$

And by solving the linear equations above, we can estimate the PID and EII coordinates of the critical point in terms of PER1, PER2 and σ^2 .

The result is as follows:

$$Z_1 = 0.0221X - \frac{0.04073}{X} - 0.00045Y - 0.00135 \frac{Y}{X} + 0.3148$$

$$Z_2 = 0.00099X - \frac{0.0003}{X} - 0.0021Y + 0.00076 \frac{Y}{X} + 0.85167$$

Change it in terms of PER1, PER2, σ^2 , EIICR₁ and PID_{cr}.

$$\begin{aligned} \text{EIICR}_1 &= 0.221 \frac{\text{PER1}}{\text{PER2}} - \frac{0.04073}{\text{PER1/PER2}} - 0.00045 \frac{\text{PER1}}{\sigma^2} \\ &\quad - 0.00135 \frac{\text{PER1/}}{\text{PER1/PER2}} + 0.3148 \end{aligned}$$

$$\begin{aligned} \text{EIICR}_1 &= 0.0221 - \frac{\text{PER1}}{\text{PER2}} - 0.04073 \frac{\text{PER2}}{\text{PER1}} - 0.00045 \frac{\text{PER1}}{\sigma^2} \\ &\quad - 0.00135 - \frac{\text{PER2}}{\sigma^2} + 0.3148 \end{aligned}$$

$$\begin{aligned} \text{PIDCR} &= 0.00099 \frac{\text{PER1}}{\text{PER2}} - 0.0003 \frac{\text{PER2}}{\text{PER1}} - 0.0021 \frac{\text{PER1}}{\sigma^2} \\ &\quad + 0.00076 \frac{\text{PER2}}{\sigma^2} + 0.85167 \end{aligned}$$

We obtain these results in five iterations (Appendix 2 includes these results). We collect data for different values of PER1, PER2 and σ^2 , then we made estimations and checked them for different PER1, PER2 and σ^2 values; if results are unsatisfactory then we give more weight to these regions by collecting more data points from these and we make estimations again, we repeat this kind of work until we get satisfactory results.

As mentioned earlier the error curve (P1DP2T versus EII) shows different characteristics before and after the critical point determined above. Now we will analyze these two regions separately.

3.4 Approximation of the Error Curve in the Interval (EII_{cr1}, ∞)

Results obtained about the error curve in this region and the general behavior are presented in Figure 3.4.

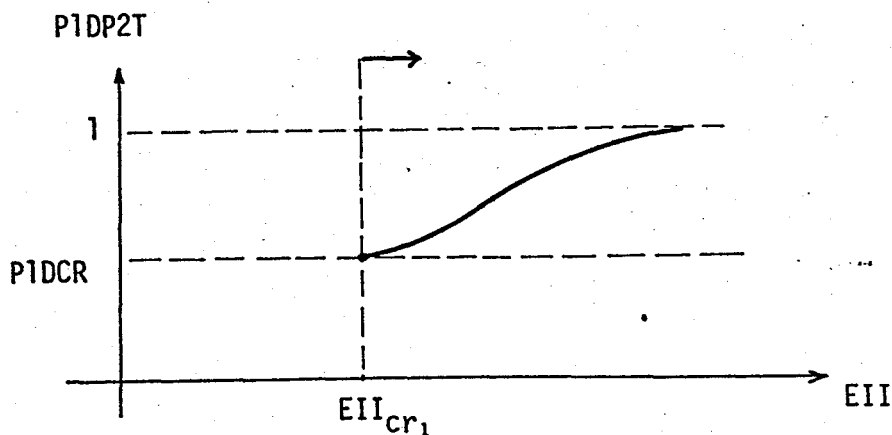


Figure 3.4

That general behavior suggests fitting a curve from "S curves" (Gombertz equation) family. (A few other types of curves here also been considered but even early results were not satisfactory.)

An S curve can simply be defined as

$$y = a \cdot b \cdot c^x \quad \text{where} \quad b, c < 1$$

S curve lies between two horizontal asymptotes; y goes to a, b when x goes to zero and y goes to a when x goes infinity.

$$y = a \cdot b \cdot c^0 = a \cdot b^1 = a \cdot b$$

$x \rightarrow 0$

$$y = a \cdot b \cdot c^\infty = a \cdot b^0 = a$$

$x \rightarrow \infty$

In our analysis $EII_i - EIICR_i$ corresponds to x variable, P1DP2T corresponds to Y variable, "a" value corresponds to 1 and also P1DCR value corresponds to "a·b".

$$a = 1$$

$$P1DCR = a \cdot b \rightarrow b = P1DCR$$

So we use S function in such a form

$$P1DP2T = P1DCR \cdot c^{(EII - EIICR)}$$

$$P1DP2T = P1DCR^c (EII - EIICR_1)$$

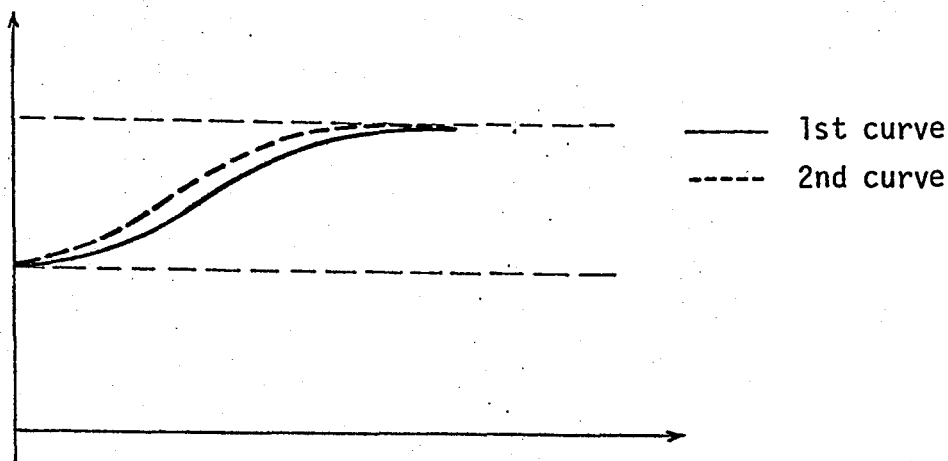


Figure 3.5

Second curve has a larger "c" value than the first one. If "c" value is higher, we can see a faster reach of P1DP2T value to the upper asymptote. We now want to find appropriate c values corresponding to given PER1, PER2 and σ^2 values. We again refer to our simulation results and gather $P1DP2T_i$ and EII_i values. (All data belongs to the rightside of the critic point.) We also note P1DCR and $EIICR_1$ values corresponding to the given parameters. Then we use the sum of square error criteria.

$$SSE = \sum_{i=1}^n (P1DP2T_i - P1DCR^c (EII_i - EIICR_1))^2$$

And we find the optimal "c" which makes the SSE value minimum, simply by making a one-dimensional search through the "c" values. At the end of this analyses, we obtain optimum c values corresponding to known PER1, PER2 and σ^2 values.

After obtaining optimal c_i values for given $PER1_i$ and $PER2_i$ and σ_i^2 values, we try to estimate "c" as a function of these parameters. By using a technique which we mention before, to estimate the coordinates of the critical point, we reach to the following result.

$$c = 0.10709 \left(\frac{PER1}{PER2} \right) - 0.02933 \left(\frac{PER2}{PER1} \right) - 0.00078 \left(\frac{PER1}{\sigma^2} \right) - 0.00096 \left(\frac{PER2}{\sigma^2} \right) + 0.272$$

Note: When we are searching optimal values for "c", we have $PER1$, $PER2$ and σ^2 values in our hand and by changing SC values we obtain $P1DP2T_i$ and EII_i values. We use these values in our regression study, but we have two alternatives for the $P1DCR$ and $EIICR_1$ values: we can use either estimation values or simulation data. We call these alternatives "estimation decision rule" and "simulation decision rule". Estimation decision rule takes the estimation errors into account and arranges "c" value. If $P1DCR1$ estimation value is less than (underestimation) its simulation value, it tries to shift the curve upwards by overestimating the c_i value, but this also causes an overestimation for high EII values. Simulation decision rule does not consider the previous estimation errors, it only tries to find appropriate c_i value which shows the general slope of the data points.

If $P1DCR1$ estimation is less than its simulation value we come to face with an underestimation for all values of EII . Figure 3.6 compares two rules.

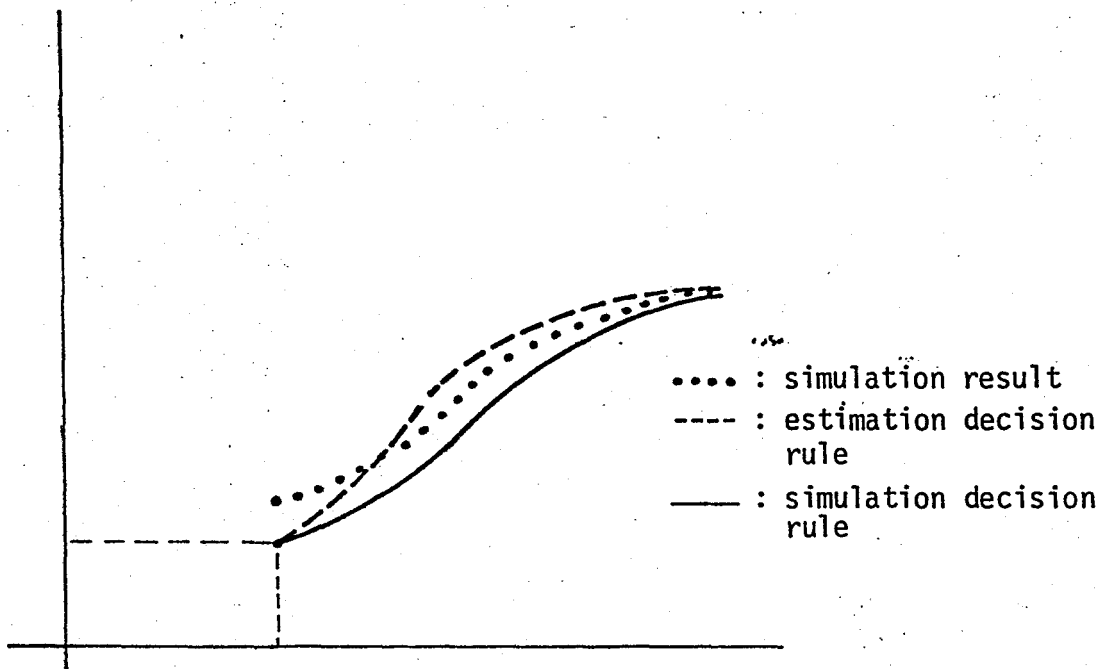


Figure 3.6

We made some tests to compare the performance of the rules, one simulation rule came out to be more successful than the estimation rule. So, we used simulation rule afterwards. (Simulation rule came out to be %78 more successful than estimation rule, estimation rule came out to be %22 more successful than simulation rule.)

We also add that, "c" value is between zero and one. If we estimate "c" less than zero, we change it to zero and if we estimate it larger than one, we change it to one.

3.5 Approximation of the Error Curve in the Interval $(-\infty, EII_{cr1})$

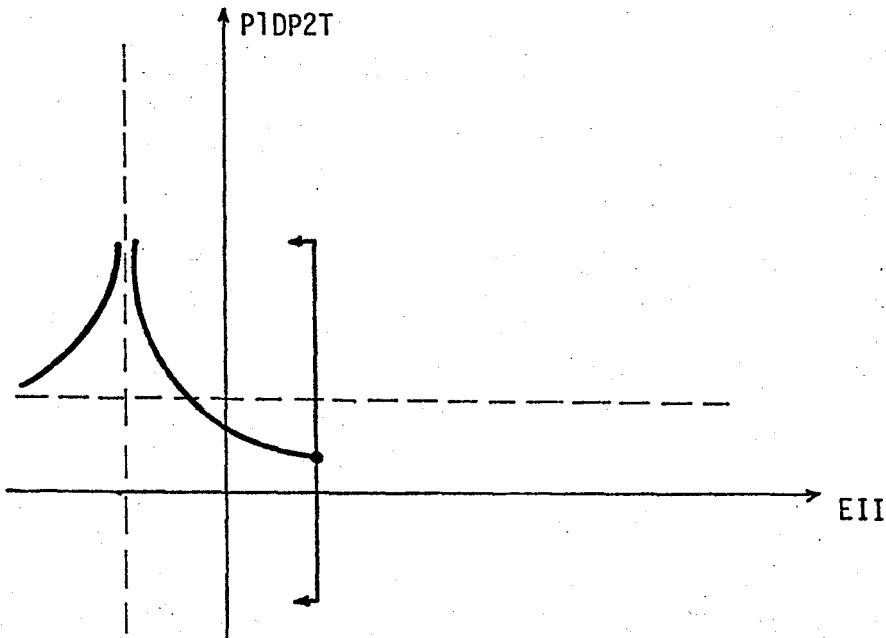


Figure 3.7.

By looking to the region before the critical point we observe a vertical asymptote and call it $EIICR_2$. When EII_i value goes to $EIICR_2$, $P1DP2T$ value goes to infinity

$$P1DP2T = \frac{P1 \pm \epsilon}{PRT \pm \epsilon}$$

The above equation tells us that when PRT value goes to zero, $P1DP2T$ value goes to infinity and we will assume $EIICR_2$ to be the EII value obtained when PRT is approximately equal to 0.01. So we will now determine the corresponding EII value when PRT equals 0.01.

$$P_r \left\{ \sum_{r=1}^{\text{PER2}} \xi_r^i > EI \right\} = 0.01$$

$$P_r \left\{ \sum_{r=1}^{\text{PER2}} \xi_r^i \leq EI \right\} = 0.99$$

$$\frac{EI - \text{PER2}}{\sigma \sqrt{\text{PER2}}} = 2.326$$

$$EI = 2.326 \sigma \sqrt{\text{PER2}} + \text{PER2}$$

$$EII = \frac{\text{PER2} - EI}{EI} = \frac{\text{PER2} - (2.326 \sigma \sqrt{\text{PER2}} + \text{PER2})}{2.326 \sigma \sqrt{\text{PER2}} + \text{PER2}}$$

$$EII = \frac{-2.326 \sigma \sqrt{\text{PER2}}}{\text{PER2} + 2.326 \sigma \sqrt{\text{PER2}}}$$

As mentioned before we will call this value $EIICR_2$. Now we are dealing with the values where EII lies between $EIICR_1$ and $EIICR_2$.

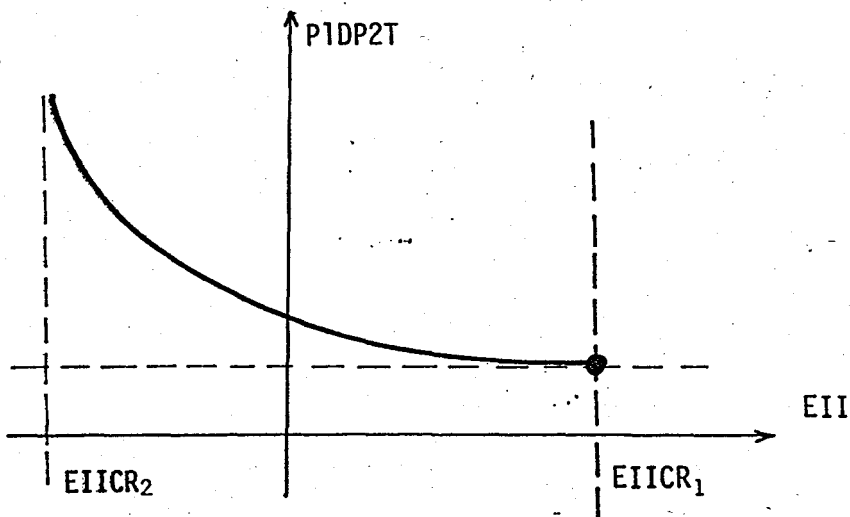


Figure 3.8

If we look the intersection region of the inequalities, $EIICR_2 \leq EII \leq EIICR_1$ and $P1DP2T \geq P1DCR$ we observe a curve which looklikes the shape of $y = \frac{k}{x^\ell}$ curve.

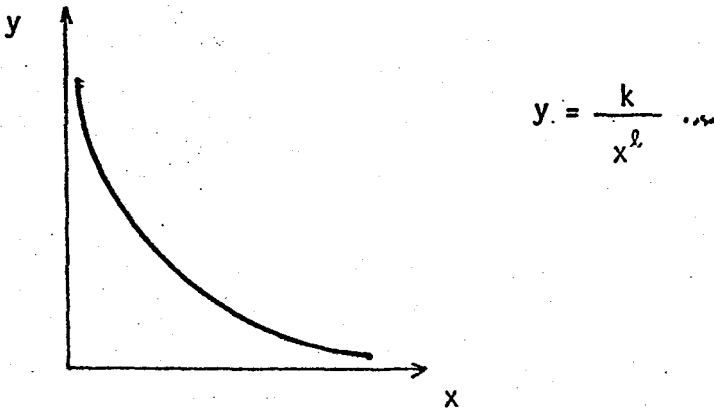


Figure 3.9

Where X_i value can be defined as $EII_i - EIICR_2$ and Y_i value can be defined as $P1DP2T_i - P1DCR$. Now our equation is in the form :

$$P1DP2T - P1DCR = \frac{k}{[EII - EIICR_2]^\ell}$$

For the purpose of simplicity we will take one of our decision variables (in this step either k or ℓ) as constant and the other as a function of $PER1$, $PER2$, σ^2 . It is obvious that to assume both of them as a function of $PER1$, $PER2$ and σ^2 will give us a better result, but it complicates our work considerably since it tries to define two dependent parameters as a function of common parameters ($PER1$, $PER2$ and σ^2). Also even if we find k and ℓ values by making a two-dimensional search over different values of $PER1$, $PER2$ and σ^2 still a

perfect fit can not be guaranteed since ℓ and k values are not independent from each other (More work must be done to solve this kind of problems.). So we prefer to keep one of the decision variables as a fixed value.

The following analysis will help in deciding which variable to keep fixed

i) k constant

$$P1DP2T - P1DCR = \frac{k}{[EII - EIICR_2]^\ell}$$

$$\rightarrow k = (P1DP2T - P1DCR)(EII - EIICR_2)^\ell$$

First, we find the $\hat{\ell}$ value which causes least deviations in k value (when we change SC or EII) under given PER1, PER2 and σ^2 values. P1DCR and EIICR₂ does not depend on SC, P1DP2T and EII values change according to SC value. Then we note the " \hat{k} " value, which corresponds to the $\hat{\ell}$ value. We repeat these steps for different PER1, PER2 and σ^2 values. At the end we compare \hat{k} 's and we find SSE (Sum of square of error) for k values.

Example 4: PER1 = 5 PER2 = 7 $\sigma^2 = 1$ Say that
P1DCR = 0.87 EIICR₂ = -0.31

SC	EII	P1DP2T	$\ell = 1.1$	$\ell = 1.3$	$\ell = 1.4$	$\ell = 1.5$
			k	k	k	k
•	-0.23	4.2	.207	.125	.096	.090
•	-0.16	2.2	.165	.113	.093	.077
•	-0.11	1.2	.048	.040	.034	.029

Among them we find $\hat{\lambda}$ equal to 1.4.

$$\hat{\lambda} = 1.4 \quad \hat{k} = \frac{(0.096 + 0.093 + 0.034)}{3} = 0.074$$

$$\hat{k} = 0.074 \quad \text{for} \quad \text{PER1} = 5, \quad \text{PER2} = 7, \quad \sigma^2 = 1$$

Finding different values for different PER1, PER2, values gives us k_i values for $i = 1, \dots, n$. Then we find SSE for k_i values.

$$\text{SSE}_k = \sum_{i=1}^n (\hat{k}_i - \bar{k})^2 \quad \text{where} \quad \bar{k} = \frac{1}{n} \sum_{i=1}^n \hat{k}_i$$

Define a new criteria (Error percentage) (EP)

$$\text{EP}_k = \frac{\text{SSE}_k}{n \bar{k}^2}$$

ii) λ is constant

Apply the same steps for the following model.

$$[\text{EII-EIICR}_2]^\lambda = \frac{k}{[\text{P1DP2T} - \text{P1DCR}]}$$

$$\lambda \ln[\text{EII-EIICR}_2] = \ln k - \ln[\text{P1DP2T} - \text{P1DCR}]$$

$$\lambda = \frac{\ln k - \ln[\text{P1DP2T} - \text{P1DCR}]}{\ln[\text{EII-EIICR}_2]}$$

and find

$$\text{EP}_\lambda = \frac{\text{SSE}_\lambda}{n \lambda^2}$$

After comparing EP_ℓ and EP_k values (we get; $EP_\ell < EP_k$). We decide to assume ℓ as a constant and k as a function of PER1, PER2 and σ^2 . We obtain value equaling 1.22 from the following analyses.

$$SSE_\ell = \sum_{i=1}^n w_i (\ell_i - \hat{\ell})^2$$

$$\frac{\partial SSE}{\partial \hat{\ell}} = -2 \sum_{i=1}^n w_i (\ell_i - \hat{\ell}) = 0 \rightarrow \hat{\ell} = \frac{\sum_{i=1}^n w_i \ell_i}{\sum_{i=1}^n w_i}$$

Now we want to express k in terms of PER1, PER2 and σ^2 values. Firstly we must find optimal k values corresponds to known PER1, PER2 and σ^2 values. For the purpose of our specific IRP we don't use the equal weighted SSE criteria to find optimal k function for given PER1, PER2 and σ^2 . Since correct estimation is considerably more important for some specific regions, we give more weight to these regions when we try to estimate optimal k function. (We give more weight to the region where stockout probability is less than %20, because for high probability regions, the deviation from real value won't make a great change on results. Stockout costs are assumed to be very high, which causes a shipment to occur before stockout probability reaches %20.)

Regression analyses gives us the following result

$$k = 0.0136 \frac{PER1}{PER2} - 0.0289 \frac{PER2}{PER1} - 0.0006 \frac{PER1}{\sigma^2} + 0.000177 \frac{PER2}{\sigma^2} + 0.0793$$

And we equate k to 0.00001 when its estimation value is less than zero.

The analysis is now almost complete. There exist one more detail.

Remember the following equation

$$PIDP2T = \frac{k}{[EII - EIICR_2]^2} + PIDCR$$

When EII goes to $EIICR_2$ we obtain a very small number in the denominator and this leads us to a very large increase in $PIDP2T$. We solve this problem by equating the denominator part to a constant m when $[EII - EIICR_2]$ value is less than some other constant n . Experimentation led to appropriate choosing $m = 0.030$ and $n = 0.030$.

We can summarize the results of our analyses. We obtain better estimates for stockout probabilities by using $PER1$, $PER2$ and σ^2 values together with table estimation value.

The full procedure is as follows:

- 1) Find EII $EII = \left(\frac{PER2 - EI}{EI}\right)$
- 2) Compare EII with $EIICR_1$. If EII is greater, then go to 6.
- 3) $PDEST = [OPTK/[EII - EIICR_2]^{1.22}] + PIDCR$
- 4) Compare EII with $EIICR_2 + 0.03$, if EII is smaller, then set $PDEST = [OPTK/(0.03)^{1.22}] + PIDCR$
- 5) Go to 7
- 6) $PDEST = PIDCR^C(EII - EIICR_1)$
- 7) $PIEST = (PRT)(PDEST)$

where $EIICR_1$, $PIDCR$, $EIICR_2$, C , $OPTK$ are the functions of our parameters. ($PER1$, $PER2$ and σ^2)

We also know that $0 < P1DCR < 1$

$0 < C < 1$

$OPTK > 0$

Note: Appendix 3 includes a computer program of our study.

IV. DISCUSSION OF THE ALGORITHM

Firstly, we must stress that this analysis is made for the purpose of a specific Inventory Routing Problem, which possess high stockout costs and high variances. It is impossible to maintain exact fit for different values of our parameters. We try to avoid high percentage of error especially at low stockout probability regions, by giving more weight or taking more sample data from there. We also give more weight to high variances cases, since table probability works fine to a certain extent for low variances cases. For very small values of PER1 like as 1,2, or 3, it is more appropriate to use table probability if PER2 is greater than 6. (Lack of fit can be seen where $\frac{PER1}{PER2} \leq \frac{1}{4}$) (We can see it in the Appendix 4.)

Our aim is to minimize the estimation error in the regions where table estimation shows a great lack of fit. Simplicity of the estimation criteria is also very important, since it directly affects the computer time requirement. For example, we deal basically with two different regions (not three because the region where $EIICR_2 + EII + EIICR_2 + 0.03$ is a narrow region.) but we can easily say that dealing with five regions will give us a better fit, but this causes more comparisons and more consumption of computer time.

We try to balance, estimation fit criteria with the simplicity of the work. For example; instead of equating α to 1.22, we may find α_{critical} in terms of our parameters, then equate the α value differently at the right and left side of this point. This will cost us much more computer time since a larger number of comparisons is added into our work.

Our study is based on two important assumptions; normality assumption and the limited range of parameters assumption. However another analyses using poissonally distribution demand showed similar characteristics. Here we assumed demand is poissonally distributed for periods and for also days.

Especially the right part of the curve (PIDP2T versus EII) indicated a proper fit with the S curve. The left part can be improved by re-estimating the α value.

In our analysis we considered the range of parameters as follows:

$$\frac{1}{2} \leq \frac{\text{PER1}}{\sigma^2} \leq \frac{20}{0.3} \quad \frac{1}{20} \leq \frac{\text{PER1}}{\text{PER2}} \leq \frac{20}{1}$$

Throughout our study we collect data from the following regions:

$$1 \leq \text{PER1} \leq 20 \quad 1 \leq \text{PER2} \leq 20 \quad 0.3 \leq \sigma^2 \leq 2.0$$

We can easily use the results of our analysis, out of these restricted regions by making small changes on our parameters.

Example :

$$\begin{aligned} \text{PER1} &= 40 & \text{PER2} &= 36 & \sigma^2 &= 1 & \text{SC} &= \text{SC}_1 \\ \text{PER1}' &= 20 & \text{PER2}' &= 18 & \sigma'^2 &= 1/2 & \text{SC}' &= \text{SC}_1/2 \end{aligned}$$

$$P\left\{ \sum_{r=1}^{\text{PER1}} \xi_r^i \leq \text{SC}_1 \right\} = P\left\{ \sum_{r=1}^{\text{PER1}'} \xi_r^i \leq \text{SC}_1' \right\}$$

$$\phi\left(\frac{\text{SC}_1 - \text{PER1}}{\sqrt{\text{PER1}}}\right) = \phi\left(\frac{\text{SC}_1' - \text{PER1}'}{\sqrt{\text{PER1}' \sigma'}}\right)$$

$$\frac{\text{SC}_1 - 40}{40 \cdot 1} = \frac{(\text{SC}_1/2) - 20}{\sqrt{20} (1/\sqrt{2})} \rightarrow \frac{\text{SC}_1 - 40}{2 \sqrt{10}} = \frac{1/2(\text{SC}_1 - 40)}{\sqrt{10}}$$

$$\frac{\text{SC}_1 - 40}{\sqrt{10}} = \frac{\text{SC}_1 - 40}{\sqrt{10}}$$

As it can be seen above our estimations won't change when we make these kind of changes on our parameters, but we observe different real probabilities (where we get from simulation) so this causes the error of our estimation to increase.

V. COMPARISON OF ERRORS

We compare percentage error of estimation and percentage error of table in the Appendix 4.

$$\text{Percentage error of estimation} = \left[\frac{PIEST - P1}{P1} \right]$$

$$\text{Percentage error of table} = \left[\frac{PRT - P1}{P1} \right]$$

$$F_1(x) = P \{ \% \text{ error of estimation} \leq x \}$$

$$F_2(x) = P \{ \% \text{ error of table} \leq x \}$$

We compare $F_1(x)$ and $F_2(x)$ for different regions of real probability value.

$.75 \leq P1 \leq 1.0$

X	F ₁ (X)	F ₂ (X)
.1	.98	.80
.2	1	.94
.3	1	.98
.4	1	1
.5	1	1
.6	1	1
.7	1	1
.8	1	1
.9	1	1
1.0	1	1

 $.5 \leq P1 \leq .75$

X	F ₁ (X)	F ₂ (X)
.1	.57	.10
.2	.97	.69
.3	1	.98
.4	1	1
.5	1	1
.6	1	1
.7	1	1
.8	1	1
.9	1	1
1.0	1	1

 $.35 \leq P1 \leq .5$

X	F ₁ (X)	F ₂ (X)
.1	.50	.59
.2	.85	.81
.3	.93	.86
.4	1	.95
.5	1	.98
.6	1	1
.7	1	1
.8	1	1
.9	1	1
1.0	1	1

 $.2 \leq P1 \leq .35$

X	F ₁ (X)	F ₂ (X)
.1	.81	.28
.2	.92	.59
.3	.95	.78
.4	.97	.92
.5	1	.96
.6	1	.98
.7	1	1
.8	1	1
.9	1	1
1.0	1	1

$.1 \leq P1 \leq .2$

X	F ₁ (X)	F ₂ (X)
.1	.69	.07
.2	.83	.16
.3	.89	.31
.4	.98	.45
.5	1	.64
.6	1	.75
.7	1	.82
.8	1	.87
.9	1	.99
1.0	1	1

 $0 \leq P1 \leq .1$

X	F ₁ (X)	F ₂ (X)
.1	.27	.07
.2	.51	.12
.3	.63	.22
.4	.78	.27
.5	.83	.37
.6	.92	.46
.7	.95	.55
.8	.98	.75
.9	.99	.93
1.0	1	1

REFERENCES

1. Or, I., "A Heuristic Solution Procedure for the Inventory Routing Problem", Research Paper FBE-EM 83/15, Boğaziçi University, 1983.
2. Meyer, Paul, L., Introductory Probability and Statistical Applications, 2nd Edition, Addison Wesley Publ. Co., N.Y., 1978.
3. Stoecker, W.F., Design of Thermal Systems, 2nd Edition, Mc Graw Hill Book Co., N.Y., 1976.
4. Wagner, Harvey M., Principles of Operations Research with Applications to Managerial Decisions, Prentice/Hall International Editions, N.Y., 1977.

APPENDIX I

Result of Simulation

PROGRAM NORM2:
 I=10.00 PER2= 4.00 SIGMA= 1.00

BSC	LI	EI	PI	PIP2T	PIDP2T	PRT
6.000	2.8057	1.0511	.8350	.1128	.8985	.9292
7.930	1.7900	1.4337	.7733	.1634	.8594	.8907
7.860	1.9027	1.9973	.7146	.1773	.8493	.8413
11.790	<u>.4177</u>	2.8210	.6073	.1801	<u>.8473</u>	.7117
12.755	.1978	3.3394	.5533	.1374	.8790	.6275
13.720	.0117	3.9538	.4653	.0917	.9158	.5081
14.635	-.1387	4.6439	.3811	.0173	1.0174	.3745
15.600	-.2622	5.4213	.3055	.2181	1.2784	.2389
16.515	-.3611	6.2605	.2356	.4516	1.8219	.1292
17.580	-.4407	7.1524	.1722	.6621	2.9543	.0582
18.545	-.5047	8.0764	.1183	.8297	5.5520	.0212
19.510	-.5567	9.0220	.0742	.9287	13.7752	.0062
21.440	-.6344	10.0000	.0243	.9876	60.6226	.0001
23.370	-.6892	12.8690	.0083	1.0000	82.4774	.0000
25.300	-.7297	14.7974	.0005	.9998	5.1553	.0000
27.230	-.7609	16.7228	.0000	.9380	.0005	.0000

PROGRAM NORM2:
 I=10.00 PER2= 5.00 SIGMA= 1.00

BSC	LI	EI	PI	PIP2T	PIDP2T	PRT
6.000	3.7571	1.0511	.8884	.0815	.9245	.9600
8.015	2.4493	1.4496	.8629	.0228	.9150	.9420
10.030	1.3976	2.0854	.7975	.1325	.8329	.9032
12.045	.6939	2.9517	.6984	.1721	.8531	.8130
13.051	<u>.1711</u>	3.5106	.6331	.1773	<u>.8493</u>	.7454
14.060	.1952	4.1833	.5531	.1582	.8633	.6430
15.068	.0117	4.9421	.4606	.1030	.9064	.5080
16.075	-.1347	5.7786	.3592	.0216	.9786	.3660
17.083	-.2522	6.6867	.2608	.1507	1.1769	.2260
18.090	-.3463	7.6368	.1879	.3557	1.5503	.1210
19.098	-.4197	8.6164	.1260	.5738	2.3419	.0537
20.105	-.4797	9.6105	.0887	.7778	4.4775	.0197
22.120	-.5697	11.6192	.0280	.9464	17.4802	.0015
24.135	-.6333	13.6349	.0084	1.0000	84.3044	.0000
26.150	-.6805	15.6476	.0005	.9998	5.2695	.0000
28.165	-.7169	17.6623	.0005	.9998	5.1553	.0000

PROGRAM NORM2:
 I=10.00 PER2= 6.00 SIGMA= 1.00

BSC	LI	EI	PI	PIP2T	PIDP2T	PRT
6.000	4.7085	1.0511	.9688	.0099	.9901	.9783
8.100	3.0309	1.4885	.9228	.0480	.9541	.9572
10.200	1.8091	2.1359	.8590	.0963	.9120	.9418
12.300	.9437	3.0869	.7596	.1598	.8622	.8810
13.350	<u>.6167</u>	3.7113	.6969	.1821	<u>.8458</u>	.8230
14.400	.3546	4.4293	.6281	.1764	.8499	.7389
15.450	.1426	5.2513	.5378	.1490	.8762	.6172
16.500	-.0257	6.1535	.4417	.0778	.9270	.4761
17.550	-.1581	7.1269	.3521	.0831	1.0933	.3220
18.600	-.2621	8.1314	.2605	.2621	1.3545	.1872
19.650	-.3451	9.1615	.1790	.4497	1.8153	.0830
20.700	-.4121	10.2061	.1141	.6180	2.6132	.0430
21.800	-.5122	12.3010	.0412	.8763	7.9221	.0000
22.900	-.5833	14.3998	.0128	.9767	32.1200	.0000
24.000	-.6363	16.4989	.0043	1.0000	42.7343	.0000
25.100	-.6774	18.5992	.0011	.9999	10.6355	.0000

BSC	EII	EI	PI	PIP2T	PIIDP2T	PET
6.000	5.6599	1.0511	.9795	.9082	.9418	.987
8.185	3.6716	1.4935	.9379	.8458	.9061	.980
10.370	2.1708	2.2076	.8978	.8747	.9304	.9649
12.555	1.1667	3.2307	.8268	.8153	.8965	.9222
13.648	.7951	3.8999	.7662	.7502	.8693	.8790
14.740	.4917	4.6926	.6940	.6639	.8591	.8078
15.833	.2556	5.5751	.6000	.5698	.8547	.7019
16.925	.0692	6.5472	.5162	.4836	.9059	.5675
18.018	-.0750	7.5674	.4042	.3311	.9696	.4168
19.110	-.1886	8.6273	.3072	.1180	1.1334	.27
20.203	-.2790	9.7087	.2183	.2950	1.4176	.153
21.295	-.3514	10.7932	.1511	.4945	1.9757	.0764
23.480	-.4607	12.9801	.0520	.7712	4.3337	.0117
25.665	-.5384	15.1662	.0195	.9487	17.7288	.001
27.850	-.5966	17.3514	.0005	.9998	5.4122	.0000
30.035	-.6416	19.5315	.0005	.9998	5.4122	.0000

PROGRAM NORM2:

BSC	EII	EI	PI	PIP2T	PIIDP2T	PET
6.000	6.6114	1.0511	.9711	.9225	.9779	.9924
8.270	4.2678	1.5187	.9669	.9208	.9795	.9890
10.540	2.5389	2.2606	.9289	.9532	.9494	.97
12.810	1.3685	3.3776	.8669	.9940	.9140	.9484
13.945	.9465	4.1099	.8005	.9427	.8750	.9142
15.080	.6149	4.9540	.7448	.9155	.8683	.857
16.215	.3548	5.9051	.6633	.8614	.8697	.770
17.350	.1533	6.9364	.5663	.8377	.8789	.644
18.485	-.0024	8.0195	.4600	.8069	.9199	.500
19.620	-.1239	9.1309	.3602	.8331	1.0340	.348
20.755	-.2203	10.2600	.2622	.8107	1.2200	.2148
21.890	-.2977	11.3917	.1835	.8625	1.5674	.117
24.160	-.4143	13.6586	.0753	.8970	3.2863	.022
26.430	-.4977	15.9281	.0282	.9077	10.4273	.002
28.700	-.5605	18.2016	.0079	1.0000	70.3140	.000
30.970	-.6092	20.4714	.0005	.9998	5.4093	.000

PROGRAM NORM2:

BSC	EII	EI	PI	PIP2T	PIIDP2T	PET
6.000	7.5628	1.0511	1.0000	.9041	1.0040	.99
8.185	4.7956	1.5529	.9902	.9032	.9967	.993
10.370	2.8557	2.3342	.9618	.9260	.9745	.980
13.065	1.5485	3.5314	.9138	.9566	.9463	.965
14.243	1.0870	4.3125	.8669	.9851	.9215	.960
15.420	.7213	5.2286	.7995	.9186	.8938	.924
16.598	.4405	6.2480	.7189	.8387	.8781	.81
17.775	.2263	7.3390	.6118	.8586	.8630	.7
18.953	.0618	8.4761	.5175	.8066	.9117	.562
20.130	-.0659	9.6347	.4141	.8066	.9932	.1
21.308	-.1671	10.8053	.3162	.8326	1.1525	.274
22.485	-.2490	11.9842	.2301	.8299	1.4274	.15
24.840	-.3724	14.3404	.0992	.8221	2.6393	.03
27.195	-.4609	16.6941	.0354	.8533	6.6871	.01
29.550	-.5276	19.0510	.0087	.9542	17.4483	.00
31.905	-.5795	21.4037	.0033	1.0000	32.6832	.00

ASC	ELL	EL	PL	PIP2T	PIOP2T	PFT
0.000	3.5142	1.0511	.9397	.0079	.9920	.9970
0.440	3.3603	1.5727	.9000	.0061	.9938	.9961
0.380	3.1455	2.0175	.8631	.0206	.9796	.9916
0.320	1.7083	3.0224	.9183	.0636	.9401	.9767
0.000	1.0000	4.0000	.8767	.0919	.9087	.9573
0.760	.8138	5.0134	.8160	.1244	.8762	.9207
0.930	.5164	6.5044	.7528	.1394	.8776	.8577
0.200	.2916	7.7426	.6457	.1787	.3483	.7611
0.470	.1191	8.9357	.5365	.1730	.8524	.6293
0.000	-.0141	10.1476	.4267	.1504	.8591	.4840
0.360	-.1197	11.3596	.3246	.0278	.9726	.3336
0.030	-.2050	12.5792	.2330	.1030	1.1143	.2000
0.520	-.3342	15.0189	.1113	.4869	1.9457	.0571
0.960	-.4272	17.4594	.0389	.7535	4.0974	.0094
0.000	-.4975	19.9000	.0110	.9179	10.9659	.0000
0.600	-.5524	22.3404	.0044	1.0000	43.8164	.0000

PROGRAM NUMBER:

ASC	ELL	EL	PL	PIP2T	PIOP2T	PFT
0.000	9.4656	1.0511	1.0000	.0014	1.0013	.9986
0.525	5.9406	1.5849	.9846	.0133	.9867	.9977
1.000	3.4557	2.0588	.9697	.0260	.9746	.9949
1.575	1.8587	3.0478	.9359	.0516	.9504	.9842
1.838	1.3078	4.0664	.8984	.0790	.9267	.9693
1.000	.8945	5.0062	.8502	.1063	.9038	.9406
1.7363	.5831	6.9483	.7844	.1330	.8825	.8888
1.8625	.3484	8.1580	.6890	.1645	.8586	.8023
1.9888	.1795	9.3978	.5986	.1434	.8745	.6844
1.150	.0331	10.6476	.4789	.1271	.8371	.5390
2.2413	-.0766	11.9125	.3804	.0347	.9662	.3936
2.3675	-.1650	13.1741	.2879	.1046	1.1163	.2578
2.6200	-.2993	15.6981	.1292	.3861	1.6269	.0793
2.8725	-.3965	18.2256	.0536	.7204	3.5523	.0190
3.1250	-.4699	20.7493	.0153	.8891	8.5143	.0017
3.3775	-.5274	23.2757	.0044	1.0000	43.7444	.0000

PROGRAM NUMBER:

ASC	ELL	EL	PL	PIP2T	PIOP2T	PFT
0.000	10.4170	1.0511	.9948	.0044	.9955	.9942
0.610	6.4916	1.6019	.9919	.0069	.9930	.9987
1.1225	3.7047	2.5506	.9820	.0150	.9852	.9987
1.3800	1.9819	4.0242	.9526	.0385	.9628	.9842
1.5130	1.4017	4.9965	.9216	.0615	.9419	.9700
1.6400	.9653	6.1058	.8721	.0955	.9127	.9554
1.7760	.6415	7.3103	.8039	.1339	.8818	.9115
1.9000	.4095	8.5683	.7237	.1592	.8626	.8589
2.0300	.2173	9.8582	.6331	.1515	.8683	.7790
2.1600	.0752	11.1612	.5262	.1303	.8346	.6440
2.2800	-.0375	12.4671	.4152	.0796	.9260	.4980
2.4000	-.1235	13.7692	.3043	.0075	.9972	.3150
2.5200	-.2070	15.0728	.1474	.2959	1.0119	.1500
2.6400	-.3681	16.3899	.0574	.6134	2.6752	.0220
2.7600	-.4440	17.6992	.0188	.8509	6.4739	.0020
2.8800	-.5043	19.0099	.0072	1.0000	71.7124	.0000

L=10.00 PER2=14.00 SIGMA= 1.00

BSC	FII	FI	PI	P1P2T	P10P2T	PET
0.000	11.3685	1.0511	1.0000	.0005	1.0004	.9995
1.035	5.9265	1.6401	.9969	.0023	.9975	.9992
1.570	3.9304	2.6367	.9927	.0052	.9947	.9979
1.935	2.0964	4.1984	.9634	.0304	.9704	.9927
1.433	1.4805	5.2408	.9400	.0471	.9549	.9842
5.730	1.0273	6.4124	.9036	.0686	.9307	.9656
5.125	.6940	7.6742	.8489	.0946	.9135	.9292
4.475	.4459	8.9910	.7798	.1103	.8806	.8658
0.823	.2587	10.3282	.6722	.1461	.8724	.7704
1.170	.1143	11.6667	.5695	.1849	.8385	.6406
3.515	-.0012	13.0153	.4449	.2238	.8037	.5000
4.865	-.0950	14.3641	.3365	.2672	.7457	.3557
7.560	-.2379	17.0591	.1743	.2462	1.3256	.1314
0.255	-.3419	19.7537	.0653	.5299	2.1202	.0307
2.950	-.4210	22.4515	.0155	.7160	3.4434	.0044
5.645	-.4830	25.1463	.0033	.8795	6.6410	.0004

PROGRAM NORM2:
L=10.00 PER2=14.00 SIGMA= 1.00

BSC	FII	FI	PI	P1P2T	P10P2T	PET
6.000	12.3199	1.0511	1.0000	.0003	1.0002	.9997
6.780	7.4615	1.6545	.9985	.0010	.9989	.9995
1.560	4.1713	2.7072	.9936	.0051	.9943	.9987
4.340	2.1942	4.3830	.9766	.0137	.9916	.9949
5.730	1.5519	5.9862	.9577	.0320	.9689	.9884
7.120	1.0829	6.7213	.9245	.0533	.9493	.9738
8.510	.7405	8.0435	.8678	.0830	.9191	.9441
9.900	.4879	9.4095	.8010	.1096	.9011	.8880
1.220	.2976	10.7891	.7175	.1183	.8941	.8073
1.600	.1424	12.1803	.6061	.1292	.8855	.6844
4.070	.0317	13.5673	.5017	.0840	.8223	.5430
5.460	-.0642	14.9605	.3865	.0383	.9629	.4073
8.240	-.2107	17.7376	.2010	.1985	1.2469	.1611
1.000	-.3177	20.5191	.0825	.5043	2.0123	.0409
3.800	-.3992	23.3010	.0249	.7351	3.7190	.0160
6.580	-.4632	26.0788	.0072	.9166	10.2833	.0000

PROGRAM NORM2:
L=10.00 PER2=15.00 SIGMA= 1.00

BSC	FII	FI	PI	P1P2T	P10P2T	PET
6.000	13.2713	1.0511	1.0000	.0000	.9999	1.0000
8.865	7.9694	1.6724	1.0000	.0003	1.0002	.9997
1.730	4.3651	2.7959	.9976	.0016	.9983	.9990
4.505	2.2782	4.5757	.9856	.0109	.9891	.9964
6.028	1.6125	5.7417	.9682	.0242	.9763	.9916
7.460	1.1301	7.0418	.9330	.0501	.9522	.9700
8.893	.7822	8.4164	.8894	.0731	.9317	.9540
10.325	.5257	9.8314	.8252	.1006	.9085	.9082
1.758	.3325	11.2573	.7420	.1207	.8922	.8010
3.100	.1820	12.6903	.6387	.1310	.8841	.7220
4.623	.0621	14.1225	.5244	.1195	.8931	.5700
6.055	-.0355	15.5522	.4156	.0689	.9353	.4400
8.920	-.1857	18.4198	.2181	.2316	1.7509	.1000
1.700	-.2250	21.2851	.0816	.3552	2.4477	.0500
4.650	-.3789	24.1499	.0300	.6963	3.2073	.0100
7.515	-.4447	27.0148	.0050	.7998	4.5406	.0000

PIK2=1.00

BSC	FI	FI	PI	PIP2T	PIOP2T	PET
.000	14.2227	1.0511	1.0000	.0000	.9999	1.0000
.750	3.3449	1.7127	.9985	.0015	.9984	1.0000
.900	4.5701	2.0699	.9977	.0018	.9981	.9995
.950	2.3516	4.7705	.9940	.0036	.9965	.9979
.325	1.6660	6.0014	.9900	.0079	.9927	.9936
.400	1.1731	7.3627	.9852	.0135	.9882	.9842
.275	.8201	8.7907	.9783	.0079	.9763	.9641
.750	.5605	10.2532	.8441	.0942	.9138	.9235
.225	.3648	11.7234	.7636	.1202	.8925	.8554
.700	<u>.2120</u>	13.2916	.6676	.1308	<u>.8642</u>	.7549
.175	.0904	14.6741	.5610	.1217	.8914	.6293
.650	-.0093	16.1499	.4467	.0924	.9152	.4880
.600	-.1622	19.0985	.2547	.1339	1.1541	.2200
.550	-.2744	22.0510	.1049	.3755	1.5933	.0655
.500	-.3600	24.9995	.0305	.5905	2.4224	.0125
.450	-.4275	27.9481	.0050	.7197	3.3297	.0014

PROGRAM NORM2:

L=10.00 PER2=17.00 SIGMA= 1.00

BSC	FI	FI	PI	PIP2T	PIOP2T	PET
0.000	15.1792	1.0511	1.0000	.0000	.9999	1.0000
1.035	8.8315	1.7291	1.0000	.0000	.9999	1.0000
2.070	4.7472	2.9580	.9970	.0027	.9972	.9997
3.105	2.4198	4.9710	.9877	.0106	.9894	.9982
4.140	1.7120	6.2684	.9769	.0188	.9814	.9953
5.175	1.2113	7.6951	.9576	.0315	.9693	.9878
6.210	.8539	9.1697	.9206	.0544	.9483	.9705
7.245	.5926	10.6741	.8717	.0749	.9303	.9370
8.280	.3942	12.1937	.8079	.0856	.9211	.8770
9.315	<u>.2400</u>	13.7101	.7175	.1020	<u>.9173</u>	.7852
10.350	.1162	15.2298	.6043	.0968	.9116	.6028
11.385	.0154	16.7425	.4772	.0978	.9108	.5239
12.420	-.1404	19.7774	.2636	.0463	1.1481	.2514
13.455	-.2548	22.8130	.1032	.2533	1.3375	.0808
14.490	-.3423	25.8492	.0355	.5439	2.1789	.0142
15.525	-.4115	28.8846	.0100	.7998	4.2566	.0020

PROGRAM NORM2:

L=10.00 PER2=18.00 SIGMA= 1.00

BSC	FI	FI	PI	PIP2T	PIOP2T	PET
0.000	16.1256	1.0511	1.0000	.0000	.9999	1.0000
1.020	9.2812	1.7508	1.0000	.0000	.9999	1.0000
2.040	4.8914	3.0553	.9978	.0022	.9977	1.0000
3.060	2.4743	5.1808	.9865	.0123	.9877	.9987
4.080	1.7524	6.5397	.9763	.0207	.9797	.9960
5.100	1.2457	8.0154	.9627	.0290	.9717	.9900
6.120	.8852	9.5479	.9344	.0452	.9566	.9700
7.140	.6218	11.0985	.8911	.0632	.9405	.9470
8.160	.4220	12.6586	.8283	.0798	.9261	.8900
9.180	<u>.2027</u>	14.2216	.7328	.1099	<u>.9009</u>	.8130
10.200	.1409	15.7774	.6372	.0962	.9121	.6900
11.220	.0380	17.3404	.5239	.0682	.9360	.5500
12.240	-.1202	20.4594	.3006	.0541	1.1568	.2500
13.260	-.2366	23.5722	.1344	.2926	1.4122	.0900
14.280	-.3258	26.6981	.0461	.5619	2.2715	.0200
15.300	-.3964	29.8187	.0078	.6529	3.7775	.0000

PER2=19.00 SIGMA= 1.00

ISC	LI	LI	PI	PIP2T	PIP2T	PRT
.000	17.0779	1.0513	1.0000	.0000	.9999	1.0000
.200	9.6179	1.7394	1.0000	.0000	.9999	1.0000
.400	5.0572	3.1394	.9979	.0021	.9979	1.0000
.600	2.5242	5.3213	.9902	.0098	.9902	.9999
.800	1.2891	8.3123	.9766	.0234	.9766	.9974
.820	1.2762	8.3471	.9755	.0228	.9775	.9927
.423	.9141	9.9262	.9467	.0365	.9647	.9812
.029	.6488	11.5234	.9001	.0625	.9310	.9564
.628	.4475	13.1262	.8374	.0866	.9202	.9099
.230	.2899	14.7298	.7575	.1033	.9022	.8340
.833	.1633	16.3327	.6576	.1172	.8955	.7291
.430	.0593	17.9362	.5282	.1247	.8890	.5948
.640	-.1011	21.1381	.2958	.0552	.9474	.3121
.845	-.2125	24.3447	.1404	.2680	1.2615	.1112
.050	-.3193	27.5474	.0472	.4700	1.8723	.0250
.255	-.3822	30.7537	.0094	.6184	2.8427	.0035

PROGRAM NORIS2:
 PER2=20.00 SIGMA= 1.00

ISC	LI	LI	PI	PIP2T	PIP2T	PRT
.000	18.0784	1.0511	1.0000	.0000	.9999	1.0000
.200	10.0519	1.8096	.9986	.0014	.9985	1.0000
.400	5.1715	3.2407	.9972	.0028	.9971	1.0000
.870	2.5651	5.6099	.9937	.0056	.9943	.9999
.510	1.8200	7.0927	.9866	.0116	.9834	.9980
.100	1.3948	8.6777	.9739	.0210	.9794	.9943
.005	.9402	10.3084	.9550	.0310	.9638	.9846
.400	.6739	11.9481	.9211	.0467	.9553	.9641
.000	.4711	13.5953	.8639	.0691	.9352	.9236
.740	.3122	15.2417	.7844	.0905	.9169	.8554
.385	.1845	16.8846	.6944	.0871	.9194	.7549
.030	.0795	18.5272	.5706	.0963	.9120	.6255
.320	-.0834	21.1817	.3439	.0021	.9876	.3446
.610	-.2035	25.1105	.1573	.1944	1.2404	.1271
.300	-.2958	28.3998	.0522	.4121	1.6955	.0307
.190	-.3689	31.6903	.0139	.6760	3.0193	.0045

PROGRAM NORIS2:
 PER2= 1.00 SIGMA= 1.00

ISC	LI	LI	PI	PIP2T	PIP2T	PRT
500	-.0694	1.0746	.4194	.1258	.8861	.4721
250	-.2771	1.3833	.3286	.0711	.9234	.3522
000	-.4694	1.8498	.2755	.2723	1.3755	.2005
750	-.5972	2.4827	.2096	.6688	3.0153	.0634
625	-.6510	2.8654	.1639	.8084	5.2039	.0314
500	-.6975	3.3063	.1549	.9309	14.3398	.0107
375	-.7388	3.8283	.1194	.9799	47.7778	.0024
250	-.7728	4.4019	.0774	.9961	193.4212	.0004
125	-.8023	5.0592	.0509	1.0000	568.7013	.0000
000	-.8268	5.7738	.0325	1.0000	325.1001	.0000
675	-.8470	6.5352	.0238	1.0000	237.9735	.0000
750	-.8638	7.3412	.0111	1.0000	111.1617	.0000
500	-.8892	9.0218	.0029	1.0000	28.8574	.0000
350	-.9070	10.7517	.0005	.9993	4.3011	.0000
100	-.9200	12.5000	.0005	.9993	4.8011	.0000
750	-.9298	14.2520	.0000	1.0810	.0000	.0000

BSC	EII	EI	PI	PIP2T	PIP2T	PII
0.500	.3617	1.0746	.7083	.0478	.2547	.7427
0.335	<u>-.4006</u>	1.4219	.5014	.0698	<u>-.2174</u>	.6556
0.170	.0520	1.9011	.4824	.0859	.9207	.5239
2.000	-.2225	2.5723	.3765	.0846	1.0971	.3446
2.923	-.3360	3.0119	.3179	.2485	1.3300	.2389
3.340	-.4295	3.5054	.2675	.4594	1.3484	.1445
4.758	-.5082	4.0671	.2133	.6620	2.0548	.0721
5.675	-.5764	4.7214	.1661	.8370	6.1115	.0274
6.593	-.6321	5.4358	.1337	.9417	16.9245	.0078
7.510	-.6779	6.2098	.0857	.9825	53.5533	.0015
8.428	-.7159	7.0398	.0599	1.0000	598.2338	.0000
9.345	-.7469	7.9099	.0406	1.0000	405.7847	.0000
1.180	-.7936	9.6906	.0135	1.0000	134.4814	.0000
2.015	-.8263	11.5120	.0058	1.0000	57.4969	.0000
2.850	-.8502	13.3518	.0010	.9999	9.5832	.0000
0.685	-.8683	15.1848	.0000	1.0850	.0005	.0000

PROGRAM NORM2:

NI=11.00 PER2= 3.00 SIGMA= 1.00

BSC	EII	EI	PI	PIP2T	PIP2T	PII
0.500	2.7918	1.0746	.7661	.1272	.0671	.0620
0.420	<u>1.4983</u>	1.4297	.6453	.2644	<u>-.7308</u>	.2159
0.340	-.5500	1.9355	.5990	.2171	.8215	.7291
2.260	.1127	2.6961	.5039	.1262	.8878	.5675
3.220	-.0511	3.1614	.4563	.0171	.9830	.4641
4.180	-.1902	3.7047	.3812	.0959	1.1053	.3460
5.140	-.3076	4.3330	.3167	.2939	1.4156	.2236
6.100	-.4051	5.0426	.2574	.5299	2.1255	.1216
7.060	-.4847	5.8215	.1917	.7256	3.6371	.0520
8.020	-.5498	6.6639	.1411	.8765	8.0605	.0174
8.980	-.6031	7.5577	.0944	.9544	21.4451	.0040
9.940	-.6461	8.4781	.0578	.9862	64.2197	.0000
1.860	-.7106	10.3670	.0178	1.0000	178.1285	.0000
2.780	-.7557	12.2806	.0074	1.0000	74.0737	.0000
2.570	-.7887	14.1995	.0015	.9999	14.3151	.0000
27.620	-.8139	16.1187	.0000	1.0230	.0005	.0000

PROGRAM NORM2:

NI=11.00 PER2= 4.00 SIGMA= 1.00

BSC	EII	EI	PI	PIP2T	PIP2T	PII
0.500	2.7224	1.0746	.8462	.0966	.9118	.0770
0.500	1.7400	1.4598	.7983	.1249	.8889	.0640
1.0510	1.0023	1.9977	.7207	.1674	.8565	.0410
2.515	<u>-.4221</u>	2.8126	.6075	.1892	<u>-.8408</u>	.7220
3.518	.2046	3.3207	.5403	.1637	.8592	.6020
4.520	.0232	3.9092	.4725	.0921	.8155	.5000
5.523	-.1309	4.6022	.3939	.0299	1.0306	.3800
6.525	-.2562	5.3778	.3139	.2090	1.2638	.2400
7.528	-.3577	6.2278	.2393	.4392	1.7813	.1300
8.530	-.4391	7.1398	.1656	.6412	2.7827	.0500
9.533	-.5051	8.0817	.1163	.8221	5.5937	.0200
10.535	-.5583	9.0556	.0791	.9254	11.1799	.0000
11.537	-.6078	10.0423	.0330	1.0000	29.5061	.0000
12.539	-.6533	11.0440	.0060	1.0000	79.8467	.0000
13.541	-.6947	12.0496	.0000	1.0020	.0005	.0000
28.555	-.7655	17.0550	.0000	1.0020	.0005	.0000

1=11.00 PEK2= 5.00 SIGMA= 1.00

BSC	II	I	P1	PIP2T	PIOP2T	PET
0.500	3.6530	1.0746	.8916	.0766	.7287	.9599
0.590	2.3928	1.4737	.8682	.0948	.9133	.9418
0.680	1.4276	2.0597	.8049	.1243	.8894	.9049
2.770	.7066	2.9298	.7206	.1325	.8774	.8212
3.815	.4324	3.4906	.6424	.1654	.8580	.7436
4.360	<u>.2079</u>	4.1393	.5546	.1683	<u>.8558</u>	.6480
5.905	.0220	4.8926	.4822	.0700	.9344	.5160
6.950	-.1275	5.7309	.3825	.0208	1.0210	.3745
7.995	-.2479	6.6483	.2864	.1932	1.2390	.2327
9.140	-.3430	7.6104	.2163	.4326	1.7610	.1230
0.085	-.4197	8.6164	.1546	.6528	2.3744	.0537
1.130	-.4814	9.6407	.0964	.8009	4.9960	.0192
3.220	-.5733	11.7190	.0362	.9641	25.8666	.0013
5.310	-.6379	13.8101	.0098	1.0000	98.1951	.0000
7.400	-.6855	15.9600	.0021	1.0000	20.6731	.0000
9.490	-.7221	17.9901	.0000	.9330	.0000	.0000

PROGRAM NORM2:

1=11.00 PEK2= 6.00 SIGMA= 1.00

BSC	II	I	P1	PIP2T	PIOP2T	PET
0.500	4.5836	1.0746	.9364	.0442	.9576	.9778
0.575	3.0077	1.4971	.8913	.0843	.9222	.9664
0.850	1.8277	2.1219	.8492	.1103	.9005	.9420
3.070	.9213	3.0438	.7682	.1519	.8680	.8847
4.113	.5376	3.6549	.7028	.1794	.8474	.8189
5.200	<u>.3716</u>	4.3745	.6207	.2009	<u>.8326</u>	.7454
6.233	.1569	5.1861	.5272	.1936	.8377	.6293
7.375	-.0153	6.0934	.4365	.1179	.8943	.4880
8.463	-.1512	7.0691	.3417	.0236	1.0238	.3326
9.550	-.2592	8.0991	.2512	.2129	1.2600	.1977
0.638	-.3448	9.1578	.1807	.4449	1.7995	.1005
1.725	-.4137	10.2337	.1149	.6284	2.6846	.0427
3.900	-.5161	12.3995	.0388	.8840	8.4313	.0045
6.075	-.5883	14.5733	.0115	1.0000	115.1393	.0000
8.250	-.6417	16.7477	.0037	1.0000	36.6515	.0000
0.425	-.6829	18.9236	.0010	.9999	10.4722	.0000

PROGRAM NORM2:

1=11.00 PEK2= 7.00 SIGMA= 1.00

BSC	II	I	P1	PIP2T	PIOP2T	PET
0.500	5.5142	1.0746	.9639	.0241	.9764	.9871
3.760	3.6165	1.5163	.9416	.0417	.9599	.9696
1.020	2.1836	2.1988	.9002	.0719	.9329	.9649
3.280	1.1940	3.1905	.8269	.1169	.8952	.9236
4.410	.8183	3.8498	.7702	.1465	.8721	.8820
5.540	<u>.2126</u>	4.6188	.6900	.1825	<u>.8456</u>	.8150
6.670	.2726	5.5004	.6033	.1806	.8467	.7123
7.800	.0825	6.4663	.4957	.1687	.8555	.5793
8.930	-.0678	7.5083	.4004	.0450	.9567	.4262
1.060	-.1851	8.5898	.3063	.1044	1.1161	.2243
1.190	-.2785	9.7014	.2218	.3060	1.4399	.1530
2.320	-.3532	10.8224	.1533	.5115	2.0642	.0749
4.580	-.4642	13.0809	.0610	.8197	5.4952	.0130
6.840	-.5437	15.3621	.0196	.9592	11.1097	.0000
9.100	-.6023	17.6001	.0048	1.0000	47.6982	.0000
1.360	-.6476	19.8610	.0000	.8850	.0000	.0000

PROGRAM NORM2:

K1=11.00

PEK2= 4.00

SIGMA= 1.00

BSC	TI	FI	PI	PIP2T	PIOP2T	PFT
6.500	6.4443	1.0746	.9873	.0155	.9744	.9927
8.345	4.2694	1.5132	.9624	.0276	.9730	.9698
11.190	2.5343	2.2635	.9452	.0350	.9660	.9738
13.535	1.4052	3.3247	.8719	.0901	.9172	.9500
14.708	.9771	4.0464	.8184	.1214	.8916	.9177
15.880	.5433	4.8682	.7617	.1347	.8812	.8660
17.253	<u>.3758</u>	5.8146	.6722	.1594	<u>.8624</u>	.7774
18.225	.1675	6.8525	.5738	.1421	.8754	.6555
19.398	.0063	7.9499	.4705	.0713	.9333	.5044
20.570	-.1261	9.0920	.3633	.0312	1.0319	.3527
21.743	-.2195	10.2494	.2600	.1739	1.2100	.2140
22.915	-.2992	11.4156	.1850	.3779	1.6061	.1151
24.200	-.4185	13.7572	.0824	.7426	3.8663	.0212
27.605	-.5932	16.1046	.0251	.9164	11.4244	.0023
29.950	-.5664	18.4518	.0059	1.0000	58.7653	.0000
32.295	-.6153	20.7949	.0011	.9999	10.6850	.0000

PROGRAM NORM2:

K1=11.00

PEK2= 9.00

SIGMA= 1.00

BSC	TI	FI	PI	PIP2T	PIOP2T	PFT
6.500	7.3754	1.0746	.9838	.0123	.9877	.9950
8.345	4.7839	1.5561	.9730	.0210	.9793	.9934
11.300	2.8643	2.3290	.9520	.0365	.9647	.9810
13.700	1.5977	3.4645	.8854	.0923	.9154	.9670
15.005	1.1244	4.2365	.8393	.1234	.8901	.9420
16.220	.7535	5.1326	.7737	.1628	.8599	.8937
17.435	<u>.4653</u>	6.1421	.7039	.1776	<u>.8491</u>	.8250
18.5	.2422	7.2449	.6231	.1539	.8665	.7190
19.8	.0709	8.4038	.5231	.0999	.9090	.5750
21.0	-.0617	9.5917	.4142	.0254	.9750	.4240
22.225	-.1665	10.7984	.3173	.1251	1.1426	.2770
23.510	-.2506	12.0093	.2265	.2993	1.4262	.1510
25.900	-.3768	14.4421	.1021	.6562	2.9000	.0350
28.370	-.4666	16.8714	.0308	.8571	6.3432	.0040
30.800	-.5337	19.2999	.0108	.9722	27.0126	.0000
33.230	-.5858	21.7286	.0027	1.0000	20.9860	.0000

PROGRAM NORM2:

K1=11.00

PEK2=10.00

SIGMA= 1.00

BSC	TI	FI	PI	PIP2T	PIOP2T	PFT
6.500	8.3060	1.0746	.9940	.0036	.9963	.9976
9.015	5.4066	1.5609	.9834	.0078	.9922	.9901
11.530	3.1764	2.3944	.9618	.0312	.9697	.9914
14.045	1.7599	3.6233	.9135	.0704	.9342	.9770
16.300	1.2490	4.4465	.8776	.0938	.9141	.9599
18.560	.8488	5.4088	.8251	.1229	.8905	.9260
20.810	.5420	6.4851	.7561	.1451	.8732	.8650
23.070	.3084	7.6429	.6542	.1776	.8491	.7700
25.330	<u>.1289</u>	8.8535	.5407	.1847	<u>.8491</u>	.6600
27.590	-.0097	10.0930	.4301	.1347	.8411	.4800
29.840	-.1189	11.3425	.3312	.0183	.9618	.3370
32.100	-.2067	12.6050	.2486	.1711	1.2058	.2060
34.360	-.3386	15.1137	.1183	.5061	2.1993	.0720
36.620	-.4370	17.6335	.0387	.7934	4.2744	.0100
38.880	-.5037	20.1494	.0062	.9144	10.2230	.0000
41.140	-.5587	22.6625	.0005	.9998	5.4477	.0000

BSC	EII	EI	P1	PIP2T	PIDP2T	PR
6.500	9.2366	1.0746	.9940	.0047	.9953	.998
9.100	5.8656	1.6022	.9834	.0145	.9856	.997
11.700	3.4984	2.4453	.9718	.0238	.9767	.994
14.300	1.9118	3.7777	.9302	.0589	.9443	.985
15.600	1.3590	4.6631	.8907	.0912	.9164	.971
16.900	.9334	5.6895	.8488	.1135	.8979	.945
18.200	.6110	6.8282	.7883	.1345	.8813	.894
19.500	.3665	8.0500	.6999	.1581	.8634	.810
20.800	<u>.1806</u>	9.3170	.5984	.1557	<u>.8652</u>	.691
22.100	.0373	10.6047	.4913	.1069	.9033	.54
23.400	-.0756	11.9000	.3862	.0193	.9809	.393
24.700	-.1666	13.1995	.2832	.1011	1.1120	.254
27.300	-.3038	15.8002	.1350	.4452	1.8000	.074
29.900	-.4022	18.3995	.0479	.7307	3.6849	.012
32.500	-.4762	20.9997	.0125	.8962	8.9432	.001
35.100	-.5339	23.6001	.0033	1.0000	32.6299	.000

PROGRAM NORM2:

PER1=11.00 PER2=12.00 SIGMA= 1.00

BSC	EII	EI	P1	PIP2T	PIDP2T	PR
6.500	10.1672	1.0746	1.0000	.0008	1.0007	.999
9.185	6.4425	1.6124	.9911	.0076	.9924	.998
11.870	3.7599	2.5211	.9758	.0215	.9789	.994
14.555	2.0503	3.9340	.9495	.0425	.9592	.989
15.898	1.4551	4.8879	.9240	.0604	.9429	.979
17.240	1.0089	5.9735	.8715	.0994	.9095	.958
18.583	.6706	7.1832	.8133	.1283	.8862	.917
19.925	.4181	8.4623	.7272	.1635	.8593	.844
21.268	<u>.2273</u>	9.7777	.6327	.1678	<u>.8562</u>	.738
22.610	.0802	11.1095	.5260	.1383	.8784	.598
23.953	-.0365	12.4546	.3997	.1217	.8913	.444
25.295	-.1301	13.7949	.2963	.0292	.9713	.305
27.980	-.2719	16.4822	.1367	.2794	1.3863	.099
30.665	-.3739	19.1658	.0503	.6084	2.5404	.011
33.350	-.4508	21.8503	.0109	.7897	4.5562	.001
36.035	-.5109	24.5332	.0033	1.0000	32.7726	.000

PROGRAM NORM2:

PER1=11.00 PER2=13.00 SIGMA= 1.00

BSC	EII	EI	P1	PIP2T	PIDP2T	PR
6.500	11.0978	1.0746	.9937	.0059	.9941	.999
9.270	6.8990	1.6458	.9963	.0029	.9970	.999
12.040	4.0150	2.5922	.9897	.0084	.9916	.999
14.810	2.1637	4.1092	.9696	.0243	.9762	.999
16.195	1.5412	5.1157	.9469	.0406	.9609	.988
17.580	1.0722	6.2736	.9153	.0583	.9448	.966
18.965	.7238	7.5416	.8544	.0937	.9142	.933
20.350	.4646	8.8762	.7705	.1330	.8825	.877
21.735	<u>.2690</u>	10.2443	.6676	.1630	<u>.8597</u>	.777
23.120	.1188	11.6192	.5604	.1563	.8647	.644
24.505	-.0003	13.0045	.4589	.0895	.9176	.500
25.890	-.0966	14.3898	.3425	.0277	.9728	.355
28.660	-.2424	17.1604	.1782	.2978	1.4230	.122
31.430	-.3477	19.9286	.0673	.5928	2.4470	.022
34.200	-.4273	22.6997	.0177	.7960	4.7704	.001
36.970	-.4896	25.4715	.0033	.9094	8.2737	.000

BSC	EII	EI	P1	P1P2T	P1DP2T	PRT
6.500	14.8202	1.0746	1.0000	.0000	.9999	1.0000
9.610	8.8997	1.7172	.9983	.0017	.9982	1.0000
12.720	4.8398	2.9111	.9976	.0021	.9978	.9997
15.830	2.5151	4.8363	.9916	.0068	.9931	.9984
17.385	1.7856	6.1028	.9807	.0155	.9846	.9959
18.940	1.2609	7.5192	.9598	.0305	.9703	.9890
20.495	.8853	9.0170	.9256	.0515	.9509	.9732
22.050	.6110	10.5524	.8735	.0768	.9286	.9406
23.605	.4044	12.1046	.7956	.1074	.9029	.8810
25.160	.2447	13.6575	.6964	.1358	.8803	.7910
26.715	.1172	15.2162	.5745	.1599	.8620	.6664
28.270	.0139	16.7673	.4609	.1279	.8864	.5199
31.380	-.1449	19.8810	.2488	.0147	1.0145	.2451
34.490	-.2606	22.9901	.1064	.3090	1.4453	.0735
37.600	-.3487	26.0997	.0388	.6416	2.7701	.0139
40.710	-.4180	29.2102	.0072	.7917	4.5014	.0015

PROGRAM NORM2:
 R1=11.00 PER2=18.00 SIGMA= 1.00

BSC	EII	EI	P1	P1P2T	P1DP2T	PRT
6.500	15.7508	1.0746	1.0000	.0000	.9999	1.0000
9.695	9.2274	1.7600	1.0000	.0000	.9999	1.0000
12.890	5.0093	2.9954	.9968	.0032	.9967	1.0000
16.085	2.5813	5.0261	.9869	.0122	.9879	.9989
17.683	1.8288	6.3632	.9784	.0189	.9814	.9969
19.280	1.2963	7.8386	.9593	.0336	.9674	.9916
20.878	.9156	9.3964	.9300	.0519	.9505	.9783
22.475	.6394	10.9797	.8868	.0718	.9329	.9505
24.073	.4318	12.5717	.8196	.0956	.9126	.8980
25.670	.2702	14.1709	.7342	.1113	.8997	.8159
27.268	.1417	15.7666	.6321	.1051	.9048	.6985
28.865	.0365	17.3661	.5089	.0920	.9156	.5557
32.060	-.1244	20.5575	.2786	.0154	1.0152	.2743
35.255	-.2422	23.7525	.1127	.2144	1.2715	.0885
38.450	-.3321	26.9498	.0372	.5186	2.0656	.0179
41.645	-.4029	30.1440	.0144	.8545	6.5584	.0021

PROGRAM NORM2:
 R1=11.00 PER2=19.00 SIGMA= 1.00

BSC	EII	EI	P1	P1P2T	P1DP2T	PRT
6.500	16.6814	1.0746	1.0000	.0000	.9999	1.0000
9.780	9.7183	1.7727	1.0000	.0000	.9999	1.0000
13.060	5.2037	3.0627	.9985	.0015	.9984	1.0000
16.340	2.6364	5.2250	.9906	.0086	.9913	.9992
17.980	1.8648	6.6323	.9831	.0149	.9852	.9977
19.620	1.3269	8.1653	.9655	.0289	.9718	.9934
21.260	.9451	9.7683	.9378	.0478	.9543	.9826
22.900	.6667	11.3995	.8935	.0734	.9315	.9591
24.540	.4572	13.0387	.8286	.1020	.9074	.9131
26.180	.2944	14.6784	.7482	.1212	.8918	.8389
27.820	.1641	16.3212	.6450	.1303	.8846	.7291
29.460	.0579	17.9607	.5280	.1193	.8933	.5910
32.740	-.1056	21.2425	.3128	.0250	1.0253	.3050
36.020	-.2250	24.5173	.1331	.2202	1.2812	.1038
39.300	-.3166	27.8002	.0433	.4868	1.9400	.0222
42.580	-.3887	31.0809	.0133	.7897	4.5901	.0028

BSC	EII	EI	P1	P1P2T	P1DP2T	PRT
6.500	17.6120	1.0746	1.0000	.0000	.9999	1.0000
9.865	10.0529	1.8095	1.0000	.0000	.9999	1.0000
13.230	5.3371	3.1560	.9978	.0022	.9977	1.0000
16.595	2.6786	5.4368	.9936	.0058	.9941	.9994
18.278	1.8987	6.8996	.9882	.0102	.9898	.9982
19.960	1.3539	8.4964	.9771	.0182	.9821	.9949
21.643	.9704	10.1503	.9528	.0350	.9661	.9861
23.325	.6915	11.8238	.9122	.0585	.9446	.9656
25.008	.4809	13.5053	.8578	.0801	.9257	.9265
26.690	.3167	15.1896	.7850	.0926	.9151	.8577
28.373	.1854	16.8717	.6839	.1038	.9058	.7549
30.055	<u>.0780</u>	18.5526	.5600	.1170	<u>.8951</u>	.6255
33.420	-.0875	21.9188	.3267	.0322	.9685	.3372
36.785	-.2090	25.2853	.1517	.2154	1.2734	.1190
40.150	-.3019	28.6478	.0567	.5271	2.1066	.0268
43.515	-.3753	32.0140	.0122	.6973	3.2164	.0037

PROGRAM NORM2:

R1=12.00 PER2= 1.00 SIGMA= 1.00

BSC	EII	EI	P1	P1P2T	P1DP2T	PRT
7.200	-.1066	1.1193	.4140	.1020	.9073	.4562
9.035	-.3123	1.4542	.3317	.0161	1.0160	.3264
10.870	-.4778	1.9151	.2850	.3634	1.5701	.1814
12.705	-.6113	2.5726	.2100	.7229	3.6022	.0582
13.623	-.6644	2.9799	.1809	.8651	7.3850	.0244
14.540	-.7086	3.4316	.1526	.9509	20.0823	.0075
15.458	-.7486	3.9779	.1217	.9877	76.0417	.0015
16.375	-.7815	4.5768	.0853	1.0000	851.9826	.0000
17.293	-.8099	5.2613	.0606	1.0000	605.4556	.0000
18.210	-.8333	6.0000	.0430	1.0000	429.7302	.0000
19.128	-.8530	6.8010	.0285	1.0000	284.4810	.0000
20.045	-.8691	7.6394	.0183	1.0000	182.7445	.0000
21.880	-.8937	9.4062	.0056	1.0000	55.7587	.0000
23.715	-.9109	11.2207	.0009	.9999	9.2762	.0000
25.550	-.9234	13.0517	.0000	1.1550	.0005	.0000
27.385	-.9328	14.8835	.0000	1.1550	.0005	.0000

PROGRAM NORM2:

R1=12.00 PER2= 2.00 SIGMA= 1.00

BSC	EII	EI	P1	P1P2T	P1DP2T	PRT
7.200	.7868	1.1193	.5562	.3168	.7593	.7324
9.120	.3477	1.4840	.5318	.2047	.8300	.6406
11.040	.0177	1.9652	.4825	.0528	.9497	.5080
12.960	-.2548	2.6837	.3836	.1773	1.2152	.3156
13.920	-.3578	3.1143	.3374	.3548	1.5491	.2177
14.880	-.4481	3.6239	.2810	.5477	2.2092	.1271
15.840	-.5264	4.2228	.2178	.7328	3.7355	.0582
16.800	-.5908	4.8878	.1608	.8712	7.7293	.0207
17.760	-.6448	5.6301	.1194	.9565	22.5317	.0052
18.720	-.6896	6.4433	.0899	.9911	99.9240	.0008
19.680	-.7262	7.3043	.0542	1.0000	541.8315	.0000
20.640	-.7562	8.2045	.0336	1.0000	335.8798	.0000
22.560	-.8015	10.0747	.0096	1.0000	95.4616	.0000
24.480	-.8330	11.9782	.0010	.9999	9.5420	.0000
26.400	-.8561	13.8999	.0000	1.0950	.0005	.0000
28.320	-.8736	15.8188	.0000	1.0950	.0005	.0000

LI	PI	LI	PI	PIP2T	PIP2T	PI
7.2300	4.3603	1.1193	.7620	.0368	.0649	.976
9.4620	2.3622	1.5535	.2234	.0449	.9569	.964
11.7200	1.7223	2.2046	.6592	.0794	.9263	.938
13.9300	.9098	3.1417	.3962	.0879	.9191	.877
15.1100	<u>.5938</u>	3.7645	.7328	.1202	<u>.8926</u>	.818
16.2900	.3382	4.4638	.6114	.1393	.8933	.729
17.3700	.1236	5.3163	.5506	.1014	.9073	.606
18.5000	-.0409	6.2499	.4494	.0241	.9762	.460
19.6300	-.1731	7.2560	.3587	.1497	1.1756	.305
20.7600	-.2788	8.3195	.2696	.3560	1.5520	.171
21.8900	-.3627	9.4147	.1867	.5639	2.2902	.082
23.0200	-.4300	10.5258	.1315	.7497	3.4835	.032
25.2300	-.5345	12.7794	.0453	.9369	15.1047	.002
27.5400	-.6019	15.0389	.0125	1.0000	124.8756	.000
29.8300	-.6532	17.3006	.0042	1.0000	41.6256	.000
32.0600	-.6932	19.5564	.0005	.9998	5.2637	.000

PROGRAM MUPB2:

LI=12.00	PIR2= 7.00	SIGMA= 1.00	LI	PI	PIP2T	PIP2T	PI	
8360			7.2300	5.2537	1.1193	.9861	.0668	.986
			9.5400	3.4673	1.5669	.9557	.0252	.979
			11.8200	2.1921	2.2560	.9101	.0585	.963
			14.2000	1.1387	3.2730	.8337	.1026	.919
			15.9200	.7770	3.9393	.7743	.1299	.874
			16.5900	<u>.5814</u>	4.7253	.6989	.1480	.812
			17.7500	.2452	5.6217	.6122	.1409	.8764
			18.2200	.0570	6.6228	.5100	.0895	.9177
			19.5200	-.0896	7.6388	.4097	.0299	1.0306
			21.2700	-.2053	9.3009	.3058	.1879	1.2309
			22.4400	-.2970	9.9573	.2192	.3765	1.4027
			23.6100	-.3706	11.1213	.1480	.5906	2.4387
			25.9600	-.4800	13.4602	.0590	.8763	7.9745
			28.3000	-.5571	15.8040	.0197	.9746	32.7841
			30.6500	-.6143	18.1510	.0098	1.0000	58.4216
			32.9200	-.6585	20.4951	.0021	1.0000	21.2446

PROGRAM NORB2:

LI=13.00	PIR2= 8.00	SIGMA= 1.00	LI	PI	PIP2T	PIP2T	PI	
850			7.2300	6.1471	1.1193	.9763	.0166	.9836
			9.6300	4.0365	1.5384	.9734	.0151	.9850
			12.0600	2.4335	2.3306	.9191	.0633	.9404
			14.4900	1.3394	3.4197	.8540	.1081	.9024
			16.7000	.9332	4.1382	.8016	.1391	.8773
			16.9200	.6085	4.9734	.7281	.1780	.8488
			18.1300	<u>.3472</u>	5.9384	.6433	.1879	<u>.8417</u>
			19.3500	.1431	6.9985	.5480	.1621	.8604
			21.0600	-.0162	8.1320	.4410	.0976	.8199
			21.7800	-.1404	9.3066	.3448	.0637	1.0677
			22.9000	-.2384	10.5040	.2532	.2520	.2362
			24.2100	-.3168	11.7092	.1835	.4818	1.1277
			24.9300	-.4343	14.1414	.0728	.7339	4.8130
			29.1700	-.5172	16.5695	.0251	.9483	13.9623
			31.5000	-.5789	19.0000	.0070	1.0000	32.6770
			33.4300	-.6267	21.4192	.0011	1.0000	1.0600

BSC	EII	EI	PI	PIP2T	PIDP2T	PRT
7.200	1.6802	1.1193	.7703	.1164	.8957	.859
9.205	1.0136	1.4899	.7347	.0924	.9094	.807
11.210	<u>.4872</u>	2.0172	.6100	.1677	<u>.8563</u>	.712
13.215	.0785	2.7816	.4927	.1118	.8992	.547
14.218	-.0795	3.2590	.4408	.0078	.9920	.444
15.220	-.2175	3.8340	.3667	.1394	1.1616	.315
16.223	-.3302	4.4789	.3111	.3645	1.5729	.197
17.225	-.4241	5.2094	.2301	.5567	2.2538	.102
18.228	-.5014	6.0174	.1606	.7454	3.9176	.040
19.230	-.5647	6.8924	.1202	.8960	9.5416	.012
20.233	-.6161	7.8150	.0829	.9662	28.5904	.002
21.235	-.6581	8.7742	.0512	.9922	102.4097	.000
23.240	-.7208	10.7463	.0180	1.0000	179.9106	.000
25.245	-.7646	12.7439	.0055	1.0000	54.9456	.000
27.250	-.7966	14.7494	.0010	.9999	9.9905	.000
29.255	-.8209	16.7544	.0000	1.0000	.0005	.000

PROGRAM NORM2:

BSC	EII	EI	PI	PIP2T	PIDP2T	PRT
7.200	2.5736	1.1193	.8497	.0887	.9184	.9251
9.290	1.6284	1.5218	.7635	.1667	.8571	.8907
11.380	.9302	2.0724	.6926	.2006	.8328	.8315
13.470	<u>.3805</u>	2.8974	.5855	.2105	<u>.8260</u>	.7083
14.515	.1689	3.4221	.5449	.1200	.8927	.6103
15.560	-.0105	4.0423	.4800	.0250	.9754	.4920
16.605	-.1577	4.7487	.3917	.0918	1.1008	.3557
17.650	-.2781	5.5411	.3228	.3166	1.4626	.2206
18.695	-.3768	6.4180	.2408	.5219	2.0899	.1151
19.740	-.4564	7.3583	.1635	.7094	3.4341	.0475
20.785	-.5205	8.3423	.1106	.8644	7.3251	.0150
21.830	-.5724	9.3556	.0766	.9504	19.6350	.0038
23.920	-.6499	11.4249	.0270	1.0000	269.4613	.0000
26.010	-.7039	13.5089	.0080	1.0000	79.8407	.0000
28.100	-.7436	15.5998	.0010	.9999	9.9805	.0000
30.190	-.7739	17.6896	.0000	1.0020	.0005	.0000

PROGRAM NORM2:

BSC	EII	EI	PI	PIP2T	PIDP2T	PRT
7.200	3.4670	1.1193	.8944	.0713	.9333	.9582
9.375	2.2698	1.5291	.8186	.1475	.8713	.9394
11.550	1.3496	2.1280	.7867	.1436	.8743	.8997
13.725	.6509	3.0286	.6880	.1782	.8487	.8100
14.813	<u>.3952</u>	3.5838	.6237	.1796	<u>.8476</u>	.7357
15.900	.1742	4.2581	.5414	.1623	.8602	.6293
16.988	-.0067	5.0337	.4600	.0783	.9272	.4960
18.075	-.1509	5.8883	.3768	.0756	1.0815	.3483
19.163	-.2681	6.8313	.2861	.2695	1.3682	.2090
20.250	-.3616	7.8322	.2015	.4847	1.9389	.1038
21.338	-.4367	8.8761	.1395	.7003	3.3285	.0418
22.425	-.4970	9.9410	.0891	.8440	6.3664	.0139
24.600	-.5868	12.1001	.0350	.9771	38.8861	.0000
26.775	-.6498	14.2759	.0082	1.0000	82.2651	.0000
28.950	-.6961	16.4516	.0021	1.0000	20.5667	.0000
31.125	-.7316	18.6255	.0005	.9998	5.1421	.0000

PROGRAM NORM2:

BSC	EII	EI	PI	P1P2T	P1DP2T	PRT
7.200	7.0405	1.1193	.9875	.0082	.9918	.995
9.715	4.5989	1.6074	.9713	.0225	.9779	.993
12.230	2.7597	2.3938	.9554	.0322	.9687	.986
14.745	1.5368	3.5478	.9011	.0708	.9338	.964
16.003	1.0819	4.3229	.8517	.1029	.9066	.939
17.260	.7187	5.2366	.7761	.1524	.8677	.894
18.518	.4370	6.2630	.6956	.1769	.8496	.818
19.775	<u>.2178</u>	7.3901	.5914	.1869	<u>.8424</u>	.701
21.033	.0491	8.5784	.4916	.1303	.8845	.555
22.290	-.0822	9.8058	.3846	.0332	.9676	.397
23.548	-.1857	11.0524	.2775	.1053	1.1172	.248
24.805	-.2686	12.3055	.1965	.3093	1.4467	.135
27.320	-.3927	14.8188	.0827	.6758	3.0730	.026
29.835	-.4808	17.3354	.0247	.8866	8.5143	.002
32.350	-.5466	19.8490	.0086	1.0000	85.7977	.000
34.865	-.5976	22.3646	.0016	.9999	16.0875	.000

PROGRAM NORM2:

BSC	EII	EI	PI	P1P2T	P1DP2T	PRT
7.200	7.9339	1.1193	.9873	.0102	.9898	.997
9.800	5.1365	1.6296	.9726	.0239	.9765	.995
12.400	3.0752	2.4538	.9520	.0413	.9602	.991
15.000	1.7044	3.6977	.9090	.0744	.9306	.976
16.300	1.2105	4.5238	.8688	.1028	.9066	.958
17.600	.8171	5.5032	.8067	.1432	.8747	.922
18.900	.5158	6.5970	.7389	.1608	.8614	.857
20.200	<u>.2844</u>	7.7855	.6501	.1661	<u>.8575</u>	.758
21.500	.1071	9.0328	.5520	.1194	.8932	.617
22.800	-.0302	10.3111	.4475	.0372	.9640	.464
24.100	-.1379	11.5998	.3496	.1177	1.1330	.308
25.400	-.2248	12.8999	.2507	.2764	1.3812	.181
28.000	-.3548	15.4997	.1001	.5822	2.3879	.041
30.600	-.4475	18.1001	.0299	.8261	5.6429	.005
33.200	-.5169	20.6994	.0049	.9183	9.7880	.000
35.800	-.5708	23.3006	.0005	.9998	5.4328	.000

PROGRAM NORM2:

BSC	EII	EI	PI	P1P2T	P1DP2T	PRT
7.200	8.8273	1.1193	1.0000	.0015	1.0014	.998
9.885	5.5883	1.6696	.9816	.0162	.9840	.997
12.570	3.3702	2.5170	.9738	.0213	.9790	.994
15.255	1.8531	3.8554	.9363	.0511	.9512	.984
16.598	1.3202	4.7409	.8975	.0806	.9253	.969
17.940	.9028	5.7808	.8549	.1017	.9076	.941
19.283	.5851	6.9395	.7889	.1266	.8875	.888
20.625	<u>.3429</u>	8.1910	.6981	.1452	<u>.8731</u>	.799
21.968	.1588	9.4923	.5961	.1301	.8848	.673
23.310	.0170	10.8162	.4836	.0750	.9301	.519
24.653	-.0948	12.1519	.3735	.0177	1.0177	.366
25.995	-.1849	13.4951	.2688	.1570	1.1858	.226
28.680	-.3202	16.1812	.1150	.4837	1.9336	.059
31.365	-.4169	18.8652	.0376	.7634	4.1803	.008
34.050	-.4895	21.5481	.0147	.9525	18.4025	.000

PROGRAM NORM2:

12.00	PER2=12.00	SIGMA= 1.00				
SC	EII	EI	P1	PIP2T	PIDP2T	PRT
200	9.7207	1.1193	1.0000	.0008	1.0007	.9992
970	6.1898	1.6690	.9982	.0004	.9995	.9986
740	3.6396	2.5864	.9854	.0113	.9887	.9966
510	1.9996	4.0005	.9567	.0341	.9670	.9893
895	1.4215	4.9557	.9278	.0550	.9478	.9788
280	.9804	6.0594	.8756	.0923	.9154	.9564
665	.6465	7.2381	.8089	.1288	.8858	.9131
050	.3963	8.5942	.7180	.1651	.8582	.8365
435	<u>.2061</u>	9.9493	.6142	.1761	<u>.8502</u>	.7224
820	.0596	11.3248	.4995	.1519	.8680	.5753
205	-.0554	12.7043	.3864	.0887	.9183	.4207
590	-.1484	14.0913	.2923	.0615	1.0652	.2743
360	-.2882	16.8586	.1357	.4048	1.6779	.0808
130	-.3887	19.6305	.0405	.6568	2.8931	.0139
900	-.4643	22.4002	.0109	.8812	7.8193	.0013
670	-.5233	25.1713	.0038	1.0000	38.2764	.0000

PROGRAM NORM2:

12.00	PER2=13.00	SIGMA= 1.00				
SC	EII	EI	P1	PIP2T	PIDP2T	PRT
200	10.6141	1.1193	1.0000	.0005	1.0004	.9995
055	6.6297	1.7039	.9927	.0064	.9935	.9991
910	3.8961	2.6552	.9831	.0151	.9851	.9979
765	2.1159	4.1721	.9532	.0414	.9602	.9927
193	1.5073	5.1848	.9365	.0514	.9510	.9846
520	1.0462	6.3531	.8928	.0832	.9231	.9671
048	.7014	7.6408	.8322	.1182	.8942	.9306
475	.4432	9.0075	.7409	.1666	.8571	.8643
903	<u>.2484</u>	10.4135	.6302	.1925	<u>.8384</u>	.7611
330	.0990	11.8287	.5327	.1741	.8516	.6255
758	-.0193	13.2563	.4276	.1040	.9056	.4721
185	-.1147	14.6848	.3121	.0344	.9664	.3228
040	-.2588	17.5394	.1535	.3123	1.4527	.1056
895	-.3626	20.3954	.0567	.6437	2.7925	.0202
750	-.4409	23.2506	.0149	.8452	6.1915	.0023
605	-.5020	26.1042	.0028	1.0000	27.4909	.0000

PROGRAM NORM2:

12.00	PER2=14.00	SIGMA= 1.00				
SC	EII	EI	P1	PIP2T	PIDP2T	PRT
200	11.5075	1.1193	1.0000	.0003	1.0002	.9997
140	7.1623	1.7152	1.0000	.0005	1.0004	.9995
080	4.1453	2.7209	.9903	.0085	.9915	.9987
020	2.2338	4.3293	.9766	.0189	.9813	.9951
490	1.5850	5.4158	.9523	.0385	.9628	.9890
960	1.1040	6.6539	.9203	.0595	.9438	.9750
430	.7493	8.0030	.8650	.0927	.9151	.9452
900	.4855	9.4242	.7996	.1116	.8995	.8888
370	.2873	10.8754	.7014	.1358	.8803	.7967
840	<u>.1345</u>	12.3401	.5767	.1618	<u>.8606</u>	.6700
310	.0138	13.8091	.4614	.1269	.8872	.5199
780	-.0838	15.2807	.3499	.0486	.9534	.3669
720	-.2316	18.2206	.1738	.2441	1.3220	.1314
660	-.3384	21.1604	.0657	.5721	2.3288	.0281
600	-.4191	24.1001	.0188	.8081	5.0713	.0036

PROGRAM NORM2:

=12.00 PER2=15.00 SIGMA= 1.00

BSC	EII	EI	P1	PIP2T	PIDP2T	PRT
7.200	12.4009	1.1193	1.0000	.0000	.9999	1.0000
0.225	7.5803	1.7482	1.0000	.0003	1.0002	.9997
3.250	4.3631	2.7969	.9932	.0061	.9939	.9992
0.275	2.3273	4.5081	.9721	.0251	.9754	.9965
7.788	1.6550	5.6498	.9536	.0402	.9612	.9920
9.300	1.1567	6.9551	.9259	.0593	.9439	.9808
0.813	.7926	8.3676	.8789	.0882	.9189	.9564
2.325	.5245	9.8395	.8177	.1106	.9003	.9082
3.838	.3225	11.3425	.7333	.1270	.8872	.8264
5.350	.1674	12.8490	.6348	.1167	.8954	.7088
0.863	<u>.0443</u>	14.3638	.5000	.1272	<u>.8870</u>	.5636
3.375	-.0551	15.8740	.3794	.0882	.9187	.4129
1.400	-.2063	18.8999	.1986	.2008	1.2504	.1587
4.425	-.3159	21.9263	.0747	.4978	1.9859	.0375
7.450	-.3988	24.9483	.0199	.7388	3.7569	.0052
0.475	-.4638	27.9737	.0055	.9277	11.0621	.0004

PROGRAM NORM2:

=12.00 PER2=16.00 SIGMA= 1.00

BSC	EII	EI	P1	PIP2T	PIDP2T	PRT
7.200	13.2942	1.1193	1.0000	.0000	.9999	1.0000
0.310	8.1017	1.7579	.9983	.0017	.9982	1.0000
3.420	4.5366	2.8898	.9950	.0045	.9954	.9995
0.530	2.4083	4.6944	.9833	.0145	.9856	.9976
3.985	1.7132	5.8972	.9625	.0329	.9681	.9941
9.640	1.2018	7.2669	.9389	.0496	.9527	.9854
1.195	.8316	8.7356	.8844	.0910	.9165	.9649
2.750	.5591	10.2622	.8292	.1139	.8977	.9236
1.305	.3555	11.8040	.7450	.1420	.8756	.8508
0.860	<u>.1976</u>	13.3598	.6495	.1476	<u>.8712</u>	.7454
7.415	.0729	14.9133	.5332	.1372	.8792	.6064
0.970	-.0287	16.4736	.4236	.0770	.9283	.4562
2.080	-.1828	19.5785	.2270	.1776	1.2153	.1867
0.190	-.2948	22.6896	.0836	.4319	1.7565	.0475
1.300	-.3798	25.7985	.0310	.7646	4.1902	.0073
0.410	-.4465	28.9087	.0078	.9226	11.0743	.0006

PROGRAM NORM2:

=12.00 PER2=17.00 SIGMA= 1.00

BSC	EII	EI	P1	PIP2T	PIDP2T	PRT
7.200	14.1876	1.1193	1.0000	.0000	.9999	1.0000
0.395	8.5139	1.7869	1.0000	.0000	.9999	1.0000
0.590	4.7253	2.9693	.9983	.0014	.9985	.9997
0.785	2.4883	4.8735	.9921	.0064	.9936	.9984
0.383	1.7652	6.1479	.9799	.0162	.9840	.9957
0.980	1.2421	7.5820	.9555	.0347	.9663	.9887
0.578	.8663	9.1087	.9283	.0469	.9551	.9719
0.175	.5916	10.6811	.8758	.0698	.9346	.9370
0.773	.3851	12.2739	.8060	.0830	.9232	.8729
0.370	<u>.2257</u>	13.8695	.6946	.1135	<u>.8980</u>	.7734
0.968	.0990	15.4692	.5881	.0955	.9127	.6443
0.565	-.0038	17.0654	.4673	.0614	.9419	.4960
0.760	-.1609	20.2607	.2578	.1667	1.1994	.2148
0.055	-.2752	22.4558	.1020	.4171	1.7515	.0475
1.300	-.3798	25.7985	.0310	.7646	4.1902	.0073
0.410	-.4465	28.9087	.0078	.9226	11.0743	.0006

PROGRAM: HURRIZ:

#12.00 PER2=18.00 SIGMA= 1.00

BSC	II	I1	P1	PIP2T	PIOP2T	PRT
.200	15.0011	1.1193	1.0000	.0000	.9999	1.0000
.400	5.0251	1.8130	1.0000	.0000	.9999	1.0000
.740	4.9969	3.0247	.9984	.0016	.9983	1.0000
.710	2.0671	5.0432	.9911	.0079	.9921	.9989
.595	1.3222	6.3780	.9778	.0194	.9809	.9968
.200	1.2362	7.4597	.9564	.0369	.9644	.9910
.715	.9968	9.4399	.9233	.0590	.9442	.9778
.595	.6380	11.0565	.8646	.0969	.9115	.9484
.135	.4190	12.6848	.7970	.1222	.8910	.8944
.325	<u>.2569</u>	14.3211	.7127	.1296	<u>.8851</u>	.8051
.455	.1200	15.9566	.6095	.1228	.8905	.6844
.575	.0035	17.5873	.5025	.0665	.9375	.5359
.300	-.1370	20.8586	.2773	.0935	1.1626	.2514
.050	-.2543	24.1395	.1170	.3600	1.5604	.0749
.700	-.3431	27.4002	.0344	.6045	2.5100	.0136
.170	-.4131	30.6699	.0094	.6845	2.9581	.0014

PROGRAM: HURRIZ:

#12.00 PER2=19.00 SIGMA= 1.00

BSC	II	I1	P1	PIP2T	PIOP2T	PRT
.200	15.0744	1.1193	1.0000	.0000	.9999	1.0000
.505	9.3633	1.8299	1.0000	.0000	.9999	1.0000
.730	5.0803	3.1249	.9964	.0016	.9983	1.0000
.275	1.0096	5.2638	.9923	.0070	.9930	.9992
.370	1.3493	6.6683	.9835	.0143	.9853	.9970
.660	1.3104	8.2236	.9653	.0289	.9716	.9932
.543	.9271	9.8592	.9422	.0419	.9597	.9817
.075	.6405	11.5255	.9013	.0611	.9423	.9564
.700	.4305	13.2085	.8361	.0843	.9222	.9060
.390	<u>.2702</u>	14.8884	.7519	.0990	<u>.9094</u>	.8264
.075	.1900	16.5703	.6462	.0969	.9115	.7085
.755	.0407	18.2561	.5415	.0480	.9541	.5675
.120	-.1211	21.6178	.3018	.0910	1.0998	.2745
.455	-.2396	24.9869	.1246	.3153	1.4588	.0653
.350	-.3298	28.3507	.0377	.5697	2.3100	.0162
.215	-.4009	31.7140	.0094	.8088	4.9543	.0018

PROGRAM: HURRIZ:

#12.00 PER2=20.00 SIGMA= 1.00

BSC	II	I1	P1	PIP2T	PIOP2T	PRT
.200	16.6678	1.1193	1.0000	.0000	.9999	1.0000
.550	9.3075	1.8500	1.0000	.0000	.9999	1.0000
.105	5.2364	3.2070	1.0000	.0000	.9999	1.0000
.905	2.6019	5.4617	.9971	.0023	.9976	.9994
.275	1.8657	6.9308	.9909	.0073	.9920	.9987
.075	1.3395	8.5489	.9766	.0186	.9816	.9943
.725	.7036	10.2374	.9494	.0379	.9634	.9854
.405	.2759	11.9483	.9061	.0640	.9395	.9641
.170	.0070	13.6741	.8361	.1012	.9090	.9207
.700	-.2937	15.4002	.7573	.1165	.8759	.8462
.025	<u>.1678</u>	17.1260	.6572	.1243	<u>.8593</u>	.7359
.350	.0011	18.8390	.5463	.0919	.9107	.5937
.800	-.1032	22.3000	.3122	.0231	1.0233	.3050
.200	-.2233	25.7494	.1350	.2570	1.3446	.1003
.700	-.3151	29.2015	.0489	.5868	2.4083	.0202
.150	-.3674	32.6593	.0139	.8272	5.5556	.0024

APPENDIX 2

Result of Linear Regression

	$\frac{PER1}{PER2}$	$\frac{PER1}{\sigma^2}$	1
PI DCR ₁	0.00107	-0.0025	0.8425
EIICR ₁	0.00581	-0.0017	0.2949

5 Iterations in our Regression

PI DCR	$\frac{PER1}{PER2}$	$\frac{PER2}{PER1}$	$\frac{PER1}{\sigma^2}$	$\frac{PER2}{\sigma^2}$	1
1st It.	0.00115	-0.00014	-0.0009	0.00055	0.8397
2nd It.	0.00145	0.00021	-0.0037	-0.00038	0.8402
3rd It.	0.00114	0.00108	-0.0013	0.00023	0.8387
4th It.	0.0012	-0.00034	-0.0016	0.00107	0.8329
5th It.	0.00099	-0.00030	-0.0021	0.00076	0.85167

EIICR ₁	$\frac{PER1}{PER2}$	$\frac{PER2}{PER1}$	$\frac{PER1}{\sigma^2}$	$\frac{PER2}{\sigma^2}$	1
1st It.	0.01982	0.04148	0.00102	0.00113	0.2885
2nd It.	0.01967	0.04218	0.00276	0.00092	0.2854
3rd It.	0.02082	0.03960	0.00254	-0.00087	0.3115
4th It.	0.02628	0.03911	-0.00103	0.00327	0.299
5th It.	0.0221	0.04073	-0.00045	-0.00135	0.3148

APPENDIX III

Computer Program

```

SPRT(16),Z(350),IJ(16),I1(16),BSC(16),AERV(16),P1EST(16)
K=1
DO 33 IJ=1,35
  READ(8,1)(HZ(JJ),JJ=K,K+9)
  K=K+10
  1  FORMAT(10I4)
33  CONTINUE
999 READ(9,*,END=9999)PER1,PER2,SC,SIGMA,SAYSC
  IF(PER1.EQ.99.)GO TO 9999
  SC=SC-SAYSC
  WRITE(6,66)
66  FORMAT(/,12X,"PROGRAM  NORM1:")
  TSC=SC
  DO 67 IC=1,16
    IF(IC.EQ.5)SAYSC=SAYSC/2.0
    IF(IC.EQ.13)SAYSC=2.0*SAYSC
    II(IC)=0
    I1(IC)=0
    TSC=TSC+SAYSC
    BSC(IC)=TSC
    ASSC=BSC(IC)
    APER1=PER1
    CALL BULERV(NZ,ASSC,PER1,SIGMA,ERV)
    PER1=APER1
67  AERV(IC)=ERV
    WRITL(6,103)PER1,PER2,SIGMA
103 FORMAT(2X,"PER1=" ,F5.2,5X,"PER2=" ,F5.2,5X,"SIGMA=" ,F7.4)
    DO 40 L=1,16
      ERV=AERV(L)
      SC=BSC(L)
      CALL BULPR2(NZ,SC,ERV,PER2,SIGMA,PR2)
      PRT(L)=PR2
40  CONTINUE
68  CALL RANHOR(A,B)
    A1=(A*SIGMA*SQRT(PER1)+PER1)
    A2=(B*SIGMA*SQRT(PER2)+PER2)
    IF(A1.LT.0.0)A1=0.0
    IF(A2.LT.0.0)A2=0.0
    CALL BULII(BSC,A1,IND1)
    IF(IND1.EQ.16)GO TO 68
    IIND=IND1+1
    DO 69 IL=IND1+1,16
      II(IL)=IJ(IL)+1
69  CONTINUE
    A2=A2+A1
    CALL BULII(BSC,A2,IND1)
    DO 70 IM=IIND,IND1
      I1(IM)=I1(IM)+1
70  CONTINUE
    IF(II(7).LT.3800)GO TO 68
C   WRITL(6,101)
C 101 FORMAT(6X,"BSC",6X,"EII",9X,"EI",10X,"P1",7X,"P1EST",5X,
C   3"P1DP2T",8X,"PRT",4X,"P1DEST")
    WRITE(6,101)
101 FORMAT(6X,"BSC",9X,"EI",10X,"P1",6X,"P1EST",9X,"PRT")
    DO 71 ID=1,16
      EI=BSC(ID)-AERV(ID)
      EII=(PER2-EI)/EI
      CALL PREST(PER1,PER2,SIGMA,EII,PPEST,XZ)
      P1DEST(ID)=PPEST
      PI1=I1(ID)
      PJI=II(ID)
      PII=PI1+C.0001

```

```

P1EST(ID)=PRT(ID)*P1DEST(ID)
P1DP2T(ID)=P1(ID)/(PRT(ID)+0.0001)
P1P2T(ID)=(P1(ID)-PRT(ID))/P1(ID)
DEN1=XZ*(P1DP2T(ID)-P1DEST(ID))
C WRITE(6,906)DEN1
C 906 FORMAT(5X,"DEN=",F15.8)
IF(P1P2T(ID).LT.0)P1P2T(ID)=-P1P2T(ID)
C WRITE(6,100)BSC(ID),EII,EI,P1(ID),P1EST(ID),P1DP2T(ID),
C SPRT(ID),P1DEST(ID)
C 100 FORMAT(3X,F7.3,1X,2(F10.4,1X),5(F10.4,1X))
WRITE(6,100)BSC(ID),EI,P1(ID),P1EST(ID),PRT(ID)
100 FORMAT(3X,F7.1,2X,4(F10.4,1X))
71 CONTINUE
GO TO 999
9999 STOP
END
SUBROUTINE BULII(BSC,AA1,IND2)
DIMENSION BSC(16)
IF(AA1.LT.BSC(11))THEN
IF(AA1.GT.BSC(1))THEN
IF(AA1.LT.BSC(6))THEN
IF(AA1.LT.BSC(4))THEN
IF(AA1.LT.BSC(3))THEN
IF(AA1.LT.BSC(2))THEN
IND2=1
ELSE
IND2=2
ENDIF
ELSE
IND2=3
ENDIF
ELSE
IF(AA1.LT.BSC(5))THEN
IND2=4
ELSE
IND2=5
ENDIF
ENDIF
ELSE
IF(AA1.LT.BSC(8))THEN
IF(AA1.LT.BSC(7))THEN
IND2=6
ELSE
IND2=7
ENDIF
ELSE
IF(AA1.LT.BSC(9))THEN
IND2=8
ELSE
IF(AA1.LT.BSC(10))THEN
IND2=9
ELSE
IND2=10
ENDIF
ENDIF
ENDIF
ELSE
IND2=0
ENDIF
ELSE
IF(AA1.LT.BSC(13))THEN
IF(AA1.LT.BSC(12))THEN
IND2=11
ELSE

```

```

ENDIF
ELSE
  IF(AA1.LT.BSC(15))THEN
    IF(AA1.LT.BSC(14))THEN
      IND2=13
    ELSE
      IND2=14
    ENDIF
  ELSE
    IF(AA1.LT.BSC(16))THEN
      IND2=15
    ELSE
      IND2=16
    ENDIF
  ENDIF
ENDIF

```

```

ENDIF
ENDIF
RETURN
END
SUBROUTINE BULERV(NZ,SSC,T,SIGMA,ERV)
DIMENSION NZ(350)
III=0
SSC1=SSC
FLUXT=0.000000001

```

```

4 IF(SSC.LT.0.0)GO TO 2
6 ZZ=(SSC-T)/(SIGMA*SQRT(T))
IF(ZZ.LE.0.0)THEN
  IF(ZZ.GE.-3.49)THEN
    LL=-100.*ZZ+1.
    FLUX=1.-NZ(LL)/10000.0
  ELSE
    FLUX=0.000001
  ENDIF
ELSE
  IF(ZZ.LE.3.49)THEN
    LL=100.0*ZZ+1.
    FLUX=NZ(LL)/10000.0
  ELSE
    FLUX=0.99999999
  ENDIF
ENDIF

```

```

ENDIF
III=III+1
IF(III.EQ.1)FLUX1=FLUX
FLUXT=FLUXT+FLUX
SSC=SSC-1.0
GO TO 4
2 EI=(FLUXT-FLUX1)/FLUX1
ERV=SSC1-EI
SSC=SSC1
RETURN
END

```

```

SUBROUTINE BULPR2(NZ,SC,ERV,Q,SIGMA,PR2)
DIMENSION NZ(350),Z(350)
PR2=0

```

```

JJJ=0
SC=SC-ERV
ZZ=(SC-Q)/(SIGMA*SQRT(Q))
C WRITE(6,120)SC,ZZ
C 120 FORMAT(2X,"SC=",F7.4,"ZZ=",F9.6)
IF(ZZ.LE.0.0)THEN
  IF(ZZ.GE.-3.49)THEN
    LL=-100*ZZ+1.
    FLUX=1.-NZ(LL)/10000.0
  ELSE

```

```

ENDIF
ELSE
  IF (ZZ.LE.3.49) THEN
    LL=100.0*ZZ+1.
    FLUX=NZ(LL)/10000.0
  ELSE
    FLUX=0.9999999
  ENDIF
ENDIF
PR2=1-FLUX
C WRITE(6,29) SC,ERV,Q,BMEAN,SIGMA,PR2
C 29 FORMAT(2X,"SC=",F5.2,2X,"ERV=",F5.2,2X,"Q=",F5.2,
C $2X,"BMEAN",F5.2,2X,"SIGMA=",F5.2,2X,"PR2=",F9.6)
RETURN
END
SUBROUTINE PREST(PER1,PER2,SIGMA,EII,PDEST,DEN)
EII CR1=0.0221*PER1/PER2-0.04073*PER2/PER1-0.00045*PER1/
$SIGMA**2.0-0.00135*PER2/SIGMA**2.0+0.3148
P1DCR=0.00099*PER1/PER2-0.0003*PER2/PER1-0.0021*PER1/
$SIGMA**2.0+0.00076*PER2/SIGMA**2.0+0.85167
IF(P1DCR.GT.1.0)P1DCR=0.9999
IF(P1DCR.LT.0.0)P1DCR=0.0001
IF(EII.GT.EII CR1)GO TO 117
EII CR2=-2.326*SIGMA*PER2**0.5/(PER2+2.326*SIGMA*PER2**0.5)
IF(EII.GT.EII CR2+0.025)GO TO 120
EII CR2=EII-0.028
120 OPTK=0.01360*PER1/PER2-0.02890*PER2/PER1-0.000600*PER1/SIGMA
$**2.0+0.000177*PER2/SIGMA**2.0+0.0793
C WRITE(6,*)OPTK
IF(OPTK.LT.0.0)OPTK=0.000001
C X=EII-EII CR2
C IF(X.GT..25)EAY=5*X-1.0
C IF(X.GT.0.1.AND.X.LT.0.3)EAY=X
C IF(X.LT.0.1)EAY=X**1.2
PDEST=OPTK/(EII-EII CR2)**1.22+P1DCR
C PDEST=OPTK/EAY+P1DCR
DEN=(EII-EII CR2)**1.22
GO TO 118
117 C=0.10709*PER1/PER2-0.02933*PER2/PER1-0.00078*PER1/
$SIGMA**2.0-0.00096*PER2/SIGMA**2.0+0.272
IF(C.GT.1.0)C=0.9999
IF(C.LT.0.0)C=0.0001
PDEST=P1DCR**(C*(EII-EII CR1))
118 CONTINUE
RETURN
END

```

APPENDIX IV

Comparison of Estimation and Table Probabilities

PER1= 5.00 PER2=10.00 SIGMA= .8000

BSC	EI	P1	P1EST	PRT
6.0	1.3945	.9986	.9997	.9997
6.6	1.7039	.9968	.9993	.9995
7.2	2.0941	.9936	.9980	.9991
7.8	2.5273	.9901	.9948	.9984
8.1	2.7672	.9873	.9921	.9978
8.4	3.0243	.9841	.9882	.9970
8.7	3.2923	.9792	.9832	.9960
9.0	3.5614	.9736	.9769	.9945
9.3	3.8364	.9696	.9692	.9925
9.6	4.1244	.9640	.9600	.9898
9.9	4.4186	.9565	.9490	.9861
10.2	4.7119	.9462	.9368	.9817
10.8	5.3003	.9230	.9068	.9678
11.4	5.9004	.8908	.8700	.9474
12.0	6.4996	.8502	.8239	.9162
12.6	7.0974	.7914	.7686	.8729

PROGRAM NORM1:

PER1= 5.00 PER2=10.00 SIGMA= 1.0000

BSC	EI	P1	P1EST	PRT
6.0	1.7272	.9858	.9952	.9955
6.6	2.0159	.9813	.9931	.9941
7.2	2.3625	.9764	.9894	.9920
7.8	2.7523	.9661	.9830	.9890
8.1	2.9759	.9593	.9782	.9868
8.4	3.1975	.9521	.9724	.9842
8.7	3.4344	.9424	.9650	.9808
9.0	3.6887	.9331	.9560	.9767
9.3	3.9383	.9242	.9459	.9719
9.6	4.2025	.9112	.9343	.9664
9.9	4.4691	.8983	.9205	.9591
10.2	4.7541	.8846	.9047	.9505
10.8	5.3199	.8512	.8689	.9292
11.4	5.9070	.8176	.8266	.9015
12.0	6.5022	.7707	.7764	.8643
12.6	7.0917	.7235	.7203	.8186

PROGRAM NORM1:

PER1= 5.00 PER2=15.00 SIGMA= .8000

BSC	EI	P1	P1EST	PRT
8.0	2.6908	.9997	.9999	1.0000
8.8	3.3752	.9987	.9993	1.0000
9.6	4.1244	.9981	.9973	1.0000
10.4	4.9081	.9960	.9925	.9994
10.8	5.3003	.9937	.9890	.9991
11.2	5.7027	.9916	.9847	.9987
11.6	6.0974	.9889	.9794	.9979
12.0	6.4970	.9871	.9732	.9969
12.4	6.9004	.9826	.9660	.9955
12.8	7.2965	.9790	.9578	.9934
13.2	7.7007	.9726	.9483	.9906
13.6	8.0974	.9634	.9376	.9868
14.4	8.9004	.9432	.9114	.9750
15.2	9.7007	.9103	.8786	.9564
16.0	10.4970	.8682	.8358	.9265
16.8	11.2965	.8132	.7817	.8830

PROGRAM NORM1:

PER1= 6.00

PER2= 5.00

SIGMA= .6000

BSC	EI	P1	P1EST	PRT
7.0	1.1434	.9694	.9906	.9979
7.6	1.4926	.9466	.9744	.9955
8.2	1.9130	.9097	.9444	.9893
8.8	2.4058	.8576	.8969	.9732
9.1	2.6624	.8293	.8672	.9591
9.4	2.9464	.7872	.8295	.9370
9.7	3.2253	.7442	.7865	.9066
10.0	3.5152	.6979	.7346	.8643
10.3	3.8095	.6489	.6754	.8106
10.6	4.1006	.5885	.7087	.7486
10.9	4.4084	.5250	.6504	.6700
11.2	4.6974	.4630	.5861	.5871
11.8	5.3026	.3451	.4452	.4129
12.4	5.9040	.2439	.3043	.2514
13.0	6.5000	.1592	.1956	.1342
13.6	7.0960	.0975	.1220	.0594

PROGRAM NORM1:

PER1= 6.00

PER2= 5.00

SIGMA= .2000

BSC	EI	P1	P1EST	PRT
7.0	.5317	1.0000	1.0000	1.0000
7.3	.8104	1.0000	1.0000	1.0000
7.6	1.1007	1.0000	.9995	1.0000
7.9	1.3996	1.0000	.9967	1.0000
8.1	1.5504	1.0000	.9935	1.0000
8.2	1.6997	1.0000	.9886	1.0000
8.4	1.8519	1.0000	.9817	1.0000
8.5	2.0000	.9997	.9730	1.0000
8.7	2.1481	.9997	.9623	1.0000
8.8	2.3003	.9995	.9493	1.0000
9.0	2.4496	.9992	.9347	1.0000
9.1	2.6004	.9979	.9182	1.0000
9.4	2.9006	.9929	.8813	1.0000
9.7	3.1963	.9726	.8410	1.0000
10.0	3.5000	.9353	.7972	.9976
10.3	3.8032	.8513	.7505	.9962

PROGRAM NORM1:

PER1= 6.00

PER2= 5.00

SIGMA= 1.0000

BSC	EI	P1	P1EST	PRT
7.0	1.8987	.8431	.8764	.9162
7.7	2.2286	.8148	.8340	.8907
8.4	2.6391	.7677	.7771	.8531
9.1	3.0955	.7122	.7091	.8023
9.5	3.3513	.6755	.6672	.7673
9.8	3.6124	.6452	.6268	.7324
10.2	3.8930	.6079	.6432	.6879
10.5	4.1868	.5652	.6082	.6406
10.9	4.4873	.5285	.5672	.5871
11.2	4.8004	.4889	.5245	.5319
11.6	5.1214	.4466	.4848	.4801
11.9	5.4488	.4043	.4366	.4207
12.6	6.1214	.3273	.3435	.3085
13.3	6.8066	.2527	.2601	.2119
14.0	7.5023	.1937	.1900	.1342
14.7	8.1933	.1391	.1367	.0778

11.54.04.UCLP, AA, PD4

0.678KLHS.

PROGRAM NORM1:

PER1= 9.00 PER2= 9.00 SIGMA= .5000

BSC	EI	P1	PIEST	PRT
17.0	7.5000	.6803	.7749	.8389
17.8	8.2521	.5429	.6660	.6879
18.5	9.0000	.4082	.5176	.5000
19.3	9.7479	.2755	.3577	.3121
19.6	10.1237	.2200	.2831	.2296
20.0	10.5000	.1682	.2155	.1587
20.4	10.8763	.1261	.1637	.1056
20.8	11.2521	.0924	.1256	.0668
21.1	11.6241	.0650	.1037	.0409
21.5	12.0000	.0447	.0985	.0228
21.9	12.3759	.0313	.0527	.0122
22.3	12.7479	.0179	.0277	.0064
23.0	13.5000	.0084	.0056	.0013
23.8	14.2521	.0029	.0000	.0000
24.5	15.0000	.0005	.0000	.0000
25.3	15.7479	.0000	.0000	.0000

PROGRAM NORM1:

PER1= 9.00 PER2= 9.00 SIGMA= .7000

BSC	EI	P1	PIEST	PRT
17.0	7.5000	.6432	.7184	.7611
17.8	8.2510	.5455	.6239	.6368
18.5	9.0000	.4363	.5144	.5000
19.3	9.7490	.3445	.3993	.3632
19.6	10.1264	.3005	.3421	.2981
20.0	10.5000	.2507	.2885	.2389
20.4	10.8736	.2232	.2399	.1867
20.8	11.2510	.1895	.1976	.1423
21.1	11.6225	.1634	.1645	.1075
21.5	12.0000	.1305	.1354	.0778
21.9	12.3775	.1061	.1136	.0548
22.3	12.7490	.0853	.0994	.0375
23.0	13.5000	.0553	.0791	.0162
23.8	14.2510	.0337	.0303	.0062
24.5	15.0000	.0184	.0107	.0022
25.3	15.7490	.0103	.0034	.0007

PROGRAM NORM1:

PER1= 9.00 PER2= 9.00 SIGMA= .9000

BSC	EI	P1	PIEST	PRT
17.0	7.5132	.6043	.6706	.7088
17.8	8.2497	.5357	.5912	.6064
18.5	9.0000	.4554	.5065	.5000
19.3	9.7555	.3763	.4187	.3936
19.6	10.1318	.3376	.3736	.3409
20.0	10.5000	.3037	.3299	.2912
20.4	10.8679	.2674	.2885	.2451
20.8	11.2442	.2384	.2505	.2033
21.1	11.6200	.2066	.2159	.1660
21.5	12.0000	.1797	.1863	.1342
21.9	12.3796	.1550	.1586	.1056
22.3	12.7555	.1305	.1361	.0823
23.0	13.5000	.0937	.1056	.0485
23.8	14.2442	.0689	.0945	.0262
24.5	15.0000	.0461	.0675	.0132
25.3	15.7555	.0308	.0317	.0062

PROGRAM NORM1:

PER1= 9.00

PER2= 9.00

SIGMA= 1.1000

BSC	EI	P1	PIEST	PRT
17.0	7.5701	.5643	.6301	.6664
17.8	8.2880	.5041	.5655	.5832
18.5	9.0189	.4449	.5000	.5000
19.3	9.7564	.3821	.4289	.4129
19.6	10.1301	.3540	.3898	.3669
20.0	10.5030	.3205	.3556	.3264
20.4	10.8754	.2947	.3223	.2877
20.8	11.2486	.2687	.2872	.2483
21.1	11.6208	.2439	.2575	.2148
21.5	11.9969	.2211	.2301	.1841
21.9	12.3729	.2042	.2017	.1539
22.3	12.7453	.1821	.1789	.1292
23.0	13.4984	.1397	.1387	.0869
23.8	14.2486	.1063	.1096	.0559
24.5	14.9969	.0755	.0951	.0351
25.3	15.7453	.0547	.1017	.0207

PROGRAM NORM1:

PER1= 9.00

PER2= 9.00

SIGMA= 1.3000

BSC	EI	P1	PIEST	PRT
17.0	7.6862	.5682	.5949	.6293
17.8	8.3625	.5182	.5443	.5636
18.5	9.0680	.4646	.4915	.4960
19.3	9.7887	.4152	.4301	.4207
19.6	10.1509	.3889	.4017	.3859
20.0	10.5200	.3613	.3738	.3520
20.4	10.8832	.3387	.3424	.3156
20.8	11.2509	.3112	.3160	.2843
21.1	11.6248	.2885	.2871	.2514
21.5	11.9957	.2641	.2631	.2236
21.9	12.3665	.2417	.2371	.1949
22.3	12.7422	.2253	.2162	.1711
23.0	13.4909	.1854	.1733	.1251
23.8	14.2344	.1535	.1406	.0901
24.5	14.9863	.1241	.1159	.0630
25.3	15.7381	.1012	.0994	.0427

PROGRAM NORM1:

PER1= 9.00

PER2= 9.00

SIGMA= 1.5000

BSC	EI	P1	PIEST	PRT
17.0	7.8631	.5424	.5666	.5987
17.8	8.4871	.5022	.5240	.5438
18.5	9.1594	.4568	.4808	.4880
19.3	9.8556	.4099	.4297	.4247
19.6	10.1953	.3914	.4079	.3974
20.0	10.5639	.3720	.3830	.3669
20.4	10.9158	.3458	.3581	.3372
20.8	11.2651	.3233	.3339	.3085
21.1	11.6436	.3066	.3109	.2810
21.5	12.0009	.2884	.2882	.2546
21.9	12.3569	.2671	.2664	.2296
22.3	12.7406	.2510	.2430	.2033
23.0	13.4857	.2145	.2058	.1611
23.8	14.2136	.1835	.1732	.1251
24.5	14.9671	.1529	.1437	.0934
25.3	15.7174	.1304	.1202	.0681

PROGRAM NORH1:

BSC	EI	P1	PIEST	PRT
20.0	10.5000	.9326	.8873	.9756
20.8	11.2492	.9037	.8585	.9591
21.5	12.0000	.8676	.8231	.9345
22.3	12.7508	.8239	.7797	.8997
22.6	13.1288	.7995	.7556	.8790
23.0	13.5000	.7655	.7294	.8554
23.4	13.8712	.7408	.6992	.8264
23.8	14.2492	.7137	.7228	.7967
24.1	14.6223	.6766	.6973	.7642
24.5	15.0000	.6461	.6663	.7257
24.9	15.3777	.6129	.6358	.6879
25.3	15.7508	.5745	.5999	.6443
26.0	16.5000	.5063	.5299	.5596
26.8	17.2492	.4363	.4563	.4721
27.5	18.0000	.3639	.3787	.3821
28.3	18.7508	.2961	.3051	.2981

PROGRAM NORH1:

BSC	EI	P1	PIEST	PRT
20.0	10.4996	.8811	.8550	.9418
20.8	11.2509	.8466	.8201	.9177
21.5	11.9992	.8121	.7803	.8869
22.3	12.7472	.7755	.7349	.8485
22.6	13.1244	.7511	.7079	.8236
23.0	13.4996	.7239	.6817	.7995
23.4	13.8737	.6984	.6544	.7734
23.8	14.2509	.6718	.6756	.7454
24.1	14.6228	.6458	.6518	.7157
24.5	14.9992	.6161	.6265	.6844
24.9	15.3751	.5884	.5999	.6517
25.3	15.7472	.5592	.5722	.6179
26.0	16.4996	.5000	.5141	.5478
26.8	17.2509	.4371	.4539	.4761
27.5	17.9992	.3832	.3936	.4052
28.3	18.7472	.3279	.3349	.3372

PROGRAM NORH1:

BSC	EI	P1	PIEST	PRT
20.0	3.3095	.9405	.9333	.9965
20.8	3.8128	.9163	.9078	.9932
21.5	4.3734	.8792	.8769	.9861
22.3	4.9847	.8401	.8394	.9719
22.6	5.3093	.8147	.8167	.9599
23.0	5.6393	.7877	.7924	.9452
23.4	5.9778	.7595	.7630	.9236
23.8	6.3275	.7244	.7312	.8980
24.1	6.6796	.6924	.6939	.8643
24.5	7.0407	.6601	.7589	.8238
24.9	7.4058	.6196	.7259	.7734
25.3	7.7703	.5808	.6891	.7190
26.0	8.5089	.4944	.5962	.5910
26.8	9.2538	.4085	.4881	.4522
27.5	10.0000	.3355	.3774	.3192
28.3	10.7503	.2646	.2735	.2033

BSC	EI	P1	P1EST	PRT
8.0	2.9020	.9962	.9988	.9991
8.8	3.5161	.9948	.9974	.9985
9.6	4.2025	.9912	.9938	.9973
10.4	4.9421	.9860	.9871	.9952
10.8	5.3199	.9807	.9822	.9936
11.2	5.7114	.9750	.9761	.9916
11.6	6.1010	.9703	.9689	.9890
12.0	6.4892	.9634	.9604	.9857
12.4	6.8959	.9574	.9504	.9817
12.8	7.2906	.9484	.9392	.9767
13.2	7.6919	.9400	.9259	.9699
13.6	8.0893	.9295	.9118	.9625
14.4	8.8920	.9035	.8774	.9418
15.2	9.6919	.8646	.8372	.9147
16.0	10.4825	.8209	.7882	.8770
16.8	11.2881	.7676	.7310	.8289

PROGRAM NORM1:

PER 1=10.00 PER 2= 5.00 SIGMA= .7000

BSC	EI	P1	P1EST	PRT
6.0	.4569	.9916	.9980	.9981
6.7	.5492	.9919	.9973	.9977
7.4	.6562	.9810	.9960	.9972
8.1	.7724	.9756	.9934	.9965
8.5	.8603	.9722	.9906	.9959
8.8	.9443	.9670	.9872	.9952
9.2	1.0364	.9582	.9827	.9943
9.5	1.1378	.9510	.9767	.9931
9.9	1.2458	.9429	.9694	.9916
10.2	1.3747	.9286	.9597	.9896
10.6	1.5234	.9187	.9472	.9868
10.9	1.6739	.9016	.9332	.9830
11.6	2.0101	.8632	.8992	.9719
12.3	2.4242	.8136	.8509	.9495
13.0	2.8972	.7503	.7880	.9099
13.7	3.4344	.6680	.7035	.8413

PROGRAM NORM1:

PER 1=10.00 PER 2= 5.00 SIGMA= 1.0000

BSC	EI	P1	P1EST	PRT
6.0	1.0511	.8939	.9490	.9608
6.7	1.1796	.8846	.9379	.9554
7.4	1.3231	.8719	.9247	.9495
8.1	1.4885	.8615	.9078	.9418
8.5	1.5780	.8518	.8979	.9370
8.8	1.6545	.8396	.8884	.9319
9.2	1.7604	.8266	.8756	.9251
9.5	1.8697	.8163	.8620	.9177
9.9	1.9932	.8049	.8473	.9099
10.2	2.1359	.7923	.8295	.8997
10.6	2.2705	.7784	.8119	.8888
10.9	2.4126	.7598	.7916	.8749
11.6	2.7277	.7242	.7480	.8438
12.3	3.0869	.6852	.6958	.8023
13.0	3.4929	.6349	.6348	.7486
13.7	3.9332	.5800	.6494	.6808

PROGRAM NORM1:

PER1=12.00 PER2=10.00 SIGMA= 1.0000

BSC	EI	P1	PIEST	PRT
20.0	7.5999	.6599	.6490	.7734
21.0	8.5397	.5835	.6498	.6772
22.0	9.5044	.5096	.5588	.5596
23.0	10.4831	.4186	.4632	.4404
23.5	10.9713	.3793	.4149	.3821
24.0	11.4640	.3367	.3637	.3228
24.5	11.9568	.2995	.3188	.2709
25.0	12.4516	.2661	.2733	.2206
25.4	12.9435	.2276	.2320	.1762
25.9	13.4433	.1979	.1988	.1401
26.4	13.9346	.1708	.1670	.1075
26.9	14.4302	.1471	.1408	.0808
27.9	15.4212	.1097	.1075	.0436
28.9	16.4127	.0753	.1099	.0217
29.9	17.4002	.0479	.0538	.0096
30.9	18.3907	.0297	.0224	.0040

PROGRAM NORM1:

PER1=18.00 PER2= 5.00 SIGMA= 1.0000

BSC	EI	P1	PIEST	PRT
20.0	3.7469	.6083	.6815	.7123
20.8	4.1329	.5610	.6389	.6480
21.5	4.5345	.5224	.5919	.5793
22.3	4.9812	.4808	.5349	.5000
22.6	5.2197	.4573	.5105	.4641
23.0	5.4791	.4312	.4738	.4168
23.4	5.7321	.4079	.4411	.3745
23.8	6.0001	.3830	.4052	.3300
24.1	6.2755	.3612	.3661	.2843
24.5	6.5643	.3376	.3339	.2451
24.9	6.8613	.3142	.2958	.2033
25.3	7.1718	.2973	.2614	.1660
26.0	7.8001	.2515	.2038	.1056
26.8	8.4569	.2147	.1624	.0618
27.5	9.1437	.1703	.1443	.0322
28.3	9.8453	.1373	.1351	.0154

PROGRAM NORM1:

PER1=18.00 PER2= 5.00 SIGMA= .6000

BSC	EI	P1	PIEST	PRT
20.0	2.4737	.8016	.7999	.9699
20.8	2.9208	.7403	.7484	.9382
21.5	3.4408	.6730	.6774	.8770
22.3	4.0217	.5844	.7064	.7642
22.6	4.3313	.5338	.6589	.6879
23.0	4.6547	.4876	.5991	.5987
23.4	4.9890	.4363	.5282	.5000
23.8	5.3344	.3929	.4581	.4052
24.1	5.6822	.3432	.3797	.3085
24.5	6.0400	.2913	.3034	.2206
24.9	6.4031	.2474	.2379	.1492
25.3	6.7669	.2067	.1858	.0951
26.0	7.5068	.1435	.1355	.0314
26.8	8.2544	.0865	.0581	.0078
27.5	9.0000	.0541	.0104	.0014
28.3	9.7484	.0308	.0000	.0000

PROGRAM NORM1:

PER1=14.00

PER2= 8.00

SIGMA= 1.0000

BSC	EI	P1	P1EST	PRT
16.0	3.3669	.8722	.8300	.9484
16.8	3.7567	.8379	.8507	.9332
17.5	4.1872	.8019	.8138	.9099
18.3	4.6608	.7652	.7721	.8810
18.6	4.9169	.7414	.7477	.8621
19.0	5.1845	.7114	.7198	.8389
19.4	5.4620	.6895	.6905	.8133
19.8	5.7495	.6664	.6596	.7852
20.1	6.0434	.6400	.6276	.7549
20.5	6.3515	.6095	.6835	.7190
20.9	6.6686	.5777	.6565	.6808
21.3	6.9884	.5515	.6238	.6368
22.0	7.6584	.4905	.5572	.5478
22.8	8.3519	.4321	.4824	.4522
23.5	9.0615	.3800	.4031	.3557
24.3	9.7849	.3175	.3238	.2643

PROGRAM NORM1:

PER1=14.00

PER2= 3.00

SIGMA= .8000

BSC	EI	P1	P1EST	PRT
16.0	2.8049	.9223	.9393	.9890
16.8	3.2295	.8944	.9141	.9821
17.5	3.7032	.8616	.8827	.9706
18.3	4.2333	.8216	.8434	.9515
18.6	4.5200	.7947	.8194	.9370
19.0	4.8144	.7705	.7931	.9192
19.4	5.1261	.7432	.7643	.8980
19.8	5.4489	.7169	.7292	.8686
20.1	5.7751	.6890	.6929	.8365
20.5	6.1160	.6567	.6513	.7967
20.9	6.4672	.6241	.7103	.7486
21.3	6.8125	.5889	.6752	.6985
22.0	7.5341	.5048	.5866	.5793
22.8	8.2700	.4244	.4910	.4562
23.5	9.0080	.3451	.3851	.3300
24.3	9.7505	.2772	.2877	.2206

PROGRAM NORM1:

PER1=10.00

PER2=10.00

SIGMA= .8000

BSC	EI	P1	P1EST	PRT
12.0	2.4553	.9839	.9909	.9936
12.8	2.9202	.9751	.9815	.9974
13.5	3.4319	.9612	.9671	.9952
14.3	4.0128	.9436	.9461	.9909
14.6	4.3296	.9304	.9330	.9875
15.0	4.6505	.9161	.9180	.9826
15.4	4.9830	.9016	.9010	.9761
15.8	5.3328	.8847	.8813	.9671
16.1	5.6750	.8622	.8597	.9554
16.5	6.0385	.8394	.8351	.9406
16.9	6.4064	.8124	.8077	.9222
17.3	6.7629	.7870	.7764	.8980
18.0	7.5068	.7121	.7045	.8365
18.8	8.2568	.6345	.7086	.7517
19.5	9.0000	.5605	.6331	.6517
20.3	9.7460	.4734	.5446	.5398

PROGRAM NORM1:
 PER1=14.00 PER2=14.00 SIGMA= .8000

BSC	EI	P1	P1EST	PRT
16.0	2.8049	.9956	.9975	1.0000
16.8	3.2295	.9939	.9946	1.0000
17.5	3.7032	.9911	.9895	.9997
18.3	4.2333	.9868	.9817	.9994
18.6	4.5200	.9852	.9767	.9992
19.0	4.8144	.9829	.9709	.9989
19.4	5.1261	.9782	.9642	.9985
19.8	5.4489	.9732	.9566	.9978
20.1	5.7751	.9672	.9483	.9969
20.5	6.1160	.9625	.9392	.9957
20.9	6.4672	.9519	.9290	.9940
21.3	6.8125	.9412	.9185	.9918
22.0	7.5341	.9157	.8939	.9846
22.8	8.2700	.8842	.8645	.9719
23.5	9.0080	.8487	.8291	.9515
24.3	9.7505	.8038	.7861	.9207

PROGRAM NORM1:

PER1=12.00 PER2= 7.00 SIGMA= .8000

BSC	EI	P1	P1EST	PRT
12.0	1.7400	.9445	.9759	.9934
12.8	2.0308	.9306	.9616	.9904
13.5	2.3724	.9106	.9413	.9854
14.3	2.7695	.8843	.9138	.9767
14.6	2.9993	.8665	.8969	.9706
15.0	3.2269	.8460	.8785	.9625
15.4	3.4829	.8229	.8565	.9515
15.8	3.7438	.8025	.8310	.9370
16.1	4.0264	.7793	.8042	.9192
16.5	4.3181	.7517	.7727	.8962
16.9	4.6289	.7162	.7378	.8686
17.3	4.9430	.6782	.6983	.8340
18.0	5.6103	.5972	.7043	.7422
18.8	6.3085	.5175	.6198	.6255
19.5	7.0295	.4374	.5207	.4960
20.3	7.7632	.3543	.4081	.3594

PROGRAM NORM1:

PER1=13.00 PER2=11.00 SIGMA= 1.5000

BSC	EI	P1	P1EST	PRT
15.0	4.6698	.8394	.8472	.8980
15.8	4.9925	.8233	.8268	.8849
16.5	5.3747	.8021	.8042	.8708
17.3	5.7865	.7751	.7759	.8508
17.6	6.0016	.7624	.7622	.8413
18.0	6.2204	.7492	.7484	.8315
18.4	6.4359	.7353	.7320	.8186
18.8	6.6711	.7187	.7173	.8078
19.1	6.9219	.7022	.6972	.7910
19.5	7.1769	.6910	.6793	.7764
19.9	7.4376	.6776	.6610	.7611
20.3	7.7129	.6621	.6424	.7454
21.0	8.2815	.6305	.5986	.7054
21.8	8.8534	.5976	.6267	.6664
22.5	9.4736	.5593	.5899	.6179
23.3	10.1175	.5237	.5514	.5675

PROGRAM NORH1:

PER1=17.00

PER2= 9.00

SIGMA= 1.0000

BSC	EI	P1	PIEST	PRT
20.0	4.1734	.8406	.8586	.9452
20.8	4.6046	.8134	.8282	.9279
21.5	5.0612	.7824	.7934	.9049
22.3	5.5754	.7459	.7508	.8729
22.6	5.8440	.7247	.7268	.8531
23.0	6.1246	.7005	.6995	.8289
23.4	6.4156	.6779	.6729	.8051
23.8	6.7117	.6492	.6428	.7764
24.1	7.0213	.6204	.7020	.7422
24.5	7.3328	.5989	.6791	.7088
24.9	7.6526	.5732	.6512	.6700
25.3	7.9811	.5461	.6214	.6293
26.0	8.6556	.4894	.5573	.5438
26.8	9.3512	.4383	.4896	.4562
27.5	10.0653	.3809	.4130	.3632
28.3	10.7928	.3254	.3398	.2776

PROGRAM NORH1:

PER1=17.00

PER2= 9.00

SIGMA= 1.0000

BSC	EI	P1	PIEST	PRT
29.0	11.5236	.2789	.2697	.2005
29.8	12.2623	.2366	.2137	.1401
30.5	13.0070	.1926	.1665	.0918
31.3	13.7558	.1526	.1333	.0571
31.6	14.1242	.1329	.1235	.0446
32.0	14.5000	.1171	.1167	.0336
32.4	14.8758	.1039	.1211	.0256
32.8	15.2486	.0921	.1254	.0188
33.1	15.6275	.0821	.0927	.0139
33.5	16.0000	.0708	.0660	.0099
33.9	16.3725	.0587	.0474	.0071
34.3	16.7514	.0495	.0327	.0049
35.0	17.5000	.0353	.0153	.0023
35.8	18.2486	.0271	.0067	.0010
36.5	19.0000	.0200	.0027	.0004
37.3	19.7514	.0111	.0000	.0000

PROGRAM NORH1:

PER1= 9.00

PER2= 9.00

SIGMA= .3000

BSC	EI	P1	PIEST	PRT
17.0	7.5000	.7897	.7149	.9515
17.8	8.2532	.5884	.6520	.7939
18.5	9.0000	.3558	.4422	.5000
19.3	9.7468	.1713	.2126	.2061
19.6	10.1267	.1061	.1278	.1056
20.0	10.5000	.0595	.0801	.0485
20.4	10.8733	.0334	.0429	.0188
20.8	11.2532	.0153	.0142	.0062
21.1	11.6203	.0053	.0041	.0018
21.5	12.0000	.0018	.0009	.0004
21.9	12.3797	.0008	.0000	.0000
22.3	12.7468	.0003	.0000	.0000
23.0	13.5000	.0003	.0000	.0000
23.8	14.2532	.0000	.0000	.0000
24.5	15.0000	.0000	.0000	.0000
25.3	15.7468	.0000	.0000	.0000

PER1=19.00 PER2= 6.00 SIGMA= .8000

BSC	E1	P1	PIEST	PRT
31.0	11.5038	.0695	.0203	.0026
31.5	12.0000	.0561	.0086	.0011
32.0	12.5000	.0429	.0039	.0005
32.5	13.0000	.0334	.0000	.0000
32.8	13.2509	.0284	.0000	.0000
33.0	13.5000	.0250	.0000	.0000
33.3	13.7491	.0213	.0000	.0000
33.5	14.0000	.0192	.0000	.0000
33.8	14.2509	.0147	.0000	.0000
34.0	14.5000	.0118	.0000	.0000
34.3	14.7491	.0092	.0000	.0000
34.5	15.0000	.0082	.0000	.0000
35.0	15.5000	.0053	.0000	.0000
35.5	16.0000	.0037	.0000	.0000
36.0	16.5000	.0029	.0000	.0000
36.5	17.0000	.0021	.0000	.0000

PROGRAM NORH1:

PER1=19.00 PER2= 6.00 SIGMA= .8000

BSC	E1	P1	PIEST	PRT
31.0	11.5038	.0698	.0203	.0026
31.5	12.0000	.0529	.0086	.0011
32.0	12.5000	.0403	.0039	.0005
32.5	13.0000	.0324	.0000	.0000
32.8	13.2509	.0268	.0000	.0000
33.0	13.5000	.0239	.0000	.0000
33.3	13.7491	.0205	.0000	.0000
33.5	14.0000	.0176	.0000	.0000
33.8	14.2509	.0158	.0000	.0000
34.0	14.5000	.0139	.0000	.0000
34.3	14.7491	.0124	.0000	.0000
34.5	15.0000	.0108	.0000	.0000
35.0	15.5000	.0079	.0000	.0000
35.5	16.0000	.0053	.0000	.0000
36.0	16.5000	.0034	.0000	.0000
36.5	17.0000	.0032	.0000	.0000

PROGRAM NORH1:

PER1=19.00 PER2= 6.00 SIGMA= .8000

BSC	E1	P1	PIEST	PRT
37.0	17.5000	.0024	.0000	.0000
37.3	17.7961	.0016	.0000	.0000
37.6	18.0992	.0016	.0000	.0000
37.9	18.4021	.0013	.0000	.0000
38.1	18.5505	.0011	.0000	.0000
38.2	18.7018	.0008	.0000	.0000
38.4	18.8529	.0008	.0000	.0000
38.5	19.0000	.0005	.0000	.0000
38.7	19.1471	.0000	.0000	.0000
38.8	19.2982	.0000	.0000	.0000
39.0	19.4425	.0000	.0000	.0000
39.1	19.5979	.0000	.0000	.0000
39.4	19.9028	.0000	.0000	.0000
39.7	20.2039	.0000	.0000	.0000
40.0	20.5000	.0000	.0000	.0000
40.3	20.7961	.0000	.0000	.0000

PROGRAM NORM1:

PER1=19.00	PER2= 6.00	SIGMA= .8000		
BSC	EI	P1	PIEST	PRT
19.0	2.3140	.8821	.8680	.9699
19.5	2.5050	.8632	.8503	.9625
20.0	2.7151	.8433	.8300	.9525
20.5	2.9227	.8172	.8103	.9418
20.8	3.0470	.8040	.7971	.9332
21.0	3.1680	.7887	.7849	.9251
21.3	3.2990	.7716	.7705	.9147
21.5	3.4346	.7580	.7555	.9032
21.8	3.5773	.7401	.7397	.8907
22.0	3.7051	.7235	.7255	.8790
22.3	3.8559	.7069	.7067	.8621
22.5	4.0119	.6914	.6869	.8438
23.0	4.3397	.6494	.6421	.7995
23.5	4.6772	.6094	.7080	.7486
24.0	5.0460	.5622	.6661	.6844
24.5	5.4343	.5238	.6148	.6103

PROGRAM NORM1:

PER1=19.00	PER2= 6.00	SIGMA= .8000		
BSC	EI	P1	PIEST	PRT
25.0	5.8337	.4761	.5583	.5319
25.5	6.2563	.4295	.4954	.4483
26.0	6.6945	.3837	.4278	.3632
26.5	7.1412	.3414	.3583	.2810
26.8	7.3716	.3197	.3279	.2451
27.0	7.6027	.3030	.2951	.2090
27.3	7.8358	.2847	.2647	.1762
27.5	8.0732	.2661	.2371	.1469
27.8	8.3126	.2463	.2088	.1190
28.0	8.5500	.2306	.1871	.0968
28.3	8.7906	.2134	.1687	.0778
28.5	9.0349	.1941	.1543	.0618
29.0	9.5232	.1649	.1358	.0367
29.5	10.0148	.1376	.1567	.0207
30.0	10.5095	.1111	.0835	.0107
30.5	11.0066	.0923	.0421	.0054

PROGRAM NORM1:

PER1=19.00	PER2= 6.00	SIGMA= .8000		
BSC	EI	P1	PIEST	PRT
25.0	5.8337	.4825	.5583	.5319
25.5	6.2563	.4367	.4954	.4483
26.0	6.6945	.3941	.4278	.3632
26.5	7.1412	.3469	.3583	.2810
26.8	7.3716	.3252	.3279	.2451
27.0	7.6027	.3038	.2951	.2090
27.3	7.8358	.2800	.2647	.1762
27.5	8.0732	.2584	.2371	.1469
27.8	8.3126	.2407	.2088	.1190
28.0	8.5500	.2201	.1871	.0968
28.3	8.7906	.2024	.1687	.0778
28.5	9.0349	.1872	.1543	.0618
29.0	9.5232	.1530	.1358	.0367
29.5	10.0148	.1233	.1567	.0207
30.0	10.5095	.0963	.0835	.0107
30.5	11.0066	.0755	.0421	.0054

PROGRAM NORK1:

PER1=19.00

PER2=11.00

SIGMA= 1.2500

BSC	EI	P1	PIEST	PRT
38.6	18.5059	.1198	.1135	.0351
38.8	19.2498	.0979	.1214	.0239
39.5	20.0000	.0845	.0990	.0150
40.3	20.7502	.0700	.0621	.0094
40.6	21.1252	.0624	.0482	.0073
41.0	21.5000	.0571	.0376	.0057
41.4	21.8748	.0508	.0290	.0044
41.8	22.2498	.0458	.0224	.0034
42.1	22.6247	.0405	.0172	.0026
42.5	23.0000	.0358	.0125	.0019
42.9	23.3753	.0329	.0092	.0014
43.3	23.7502	.0300	.0073	.0011
44.0	24.5000	.0234	.0040	.0006
44.8	25.2498	.0192	.0020	.0003
45.5	26.0000	.0139	.0000	.0000
46.3	26.7502	.0097	.0000	.0000

PROGRAM NORK1:

PER1=19.00

PER2=11.00

SIGMA= 1.2500

BSC	EI	P1	PIEST	PRT
38.0	18.5059	.1190	.1135	.0351
38.8	19.2498	.0984	.1214	.0239
39.5	20.0000	.0829	.0990	.0150
40.3	20.7502	.0618	.0621	.0094
40.6	21.1252	.0566	.0482	.0073
41.0	21.5000	.0511	.0376	.0057
41.4	21.8748	.0463	.0290	.0044
41.8	22.2498	.0419	.0224	.0034
42.1	22.6247	.0358	.0172	.0026
42.5	23.0000	.0321	.0125	.0019
42.9	23.3753	.0284	.0092	.0014
43.3	23.7502	.0253	.0073	.0011
44.0	24.5000	.0199	.0040	.0006
44.8	25.2498	.0134	.0020	.0003
45.5	26.0000	.0092	.0000	.0000
46.3	26.7502	.0068	.0000	.0000

PROGRAM NORK1:

PER1=19.00

PER2=11.00

SIGMA= 1.6000

BSC	EI	P1	PIEST	PRT
38.0	18.5646	.1821	.1495	.0778
38.8	19.2985	.1598	.1324	.0594
39.5	20.0315	.1441	.1202	.0446
40.3	20.7660	.1303	.1142	.0329
40.6	21.1358	.1232	.1149	.0281
41.0	21.5138	.1163	.1198	.0239
41.4	21.8908	.1092	.1311	.0202
41.8	22.2628	.0987	.1152	.0170
42.1	22.6331	.0895	.0969	.0143
42.5	23.0033	.0831	.0807	.0119
42.9	23.3729	.0757	.0671	.0099
43.3	23.7459	.0710	.0556	.0082
44.0	24.4950	.0600	.0373	.0055
44.8	25.2465	.0515	.0251	.0037
45.5	25.9937	.0410	.0163	.0024
46.3	26.7385	.0331	.0102	.0015

6.000	-.0486	1.0511	.4676	.0267	.9737	.4801
7.675	-.2714	1.3726	.3697	.0378	1.0389	.3557
9.350	-.4525	1.8265	.2801	.2642	1.3584	.2061
11.025	-.5939	2.4622	.2083	.6539	2.8855	.0721
11.863	-.6511	2.8665	.1691	.8144	5.3698	.0314
12.700	-.6978	3.3092	.1429	.9251	13.2275	.0107
13.538	-.7391	3.8334	.1072	.9785	44.6759	.0023
14.375	-.7732	4.4100	.0760	.9961	189.9737	.0003
15.213	-.8024	5.0596	.0576	1.0000	575.6614	.0000
16.050	-.8264	5.7589	.0498	1.0000	497.7760	.0000
16.888	-.8464	6.5109	.0249	1.0000	248.4113	.0000
17.725	-.8628	7.2905	.0150	1.0000	149.5371	.0000
19.400	-.8878	8.9160	.0029	1.0000	28.8178	.0000
21.075	-.9054	10.5718	.0010	.9999	9.5924	.0000
22.750	-.9184	12.2498	.0000	1.0830	.0005	.0000
24.425	-.9282	13.9244	.0000	1.0830	.0005	.0000

PROGRAM NORM2:

ERR=10.00 PER2= 2.00 SIGMA= 1.00

BSC	EII	EI	P1	PIP2T	PIDP2T	PRT
6.000	.9028	1.0511	.6748	.1094	.9012	.7486
7.760	.4418	1.3872	.6155	.0826	.9236	.6664
9.520	.0584	1.8896	.4989	.0582	.9448	.5279
11.280	-.2233	2.5751	.3728	.0758	1.0816	.3446
12.160	-.3349	3.0069	.3316	.2795	1.3874	.2389
13.040	-.4296	3.5066	.2809	.4852	1.9413	.1446
13.920	-.5112	4.0921	.2017	.6489	2.8444	.0708
14.800	-.5778	4.7371	.1525	.8242	5.6674	.0268
15.680	-.6328	5.4467	.1173	.9360	15.4279	.0075
16.560	-.6780	6.2112	.0741	.9798	46.3434	.0015
17.440	-.7151	7.0212	.0419	1.0000	418.7736	.0000
18.320	-.7455	7.8590	.0266	1.0000	265.5323	.0000
20.080	-.7914	9.5866	.0100	1.0000	99.8507	.0000
21.840	-.8236	11.3404	.0025	1.0000	24.9506	.0000
23.600	-.8473	13.0985	.0000	1.0020	.0005	.0000
25.360	-.8654	14.8610	.0000	1.0020	.0005	.0000

PROGRAM NORM2:

ERR=10.00 PER2= 3.00 SIGMA= 1.00

BSC	EII	EI	P1	PIP2T	PIDP2T	PRT
6.000	1.8543	1.0511	.7569	.1476	.8713	.8686
7.845	<u>1.1108</u>	1.4213	.6719	.2183	<u>.8207</u>	.8186
9.690	.5523	1.9326	.5991	.2170	.8216	.7291
11.535	.1121	2.6975	.4926	.1520	.8679	.5679
12.458	-.0549	3.1742	.4393	.0476	.9543	.4607
13.380	-.1961	3.7316	.3645	.0749	1.0806	.3377
14.303	-.3110	4.3544	.3011	.2770	1.3825	.2177
15.225	-.4079	5.0671	.2356	.5035	2.0123	.1170
16.148	-.4868	5.8459	.1683	.6999	3.3261	.0500
17.070	-.5505	6.6745	.1212	.8598	7.0902	.0170
17.993	-.6026	7.5489	.0763	.9424	16.9644	.0044
18.915	-.6446	8.4403	.0448	.9821	49.7430	.0000
20.760	-.7077	10.2649	.0155	1.0000	155.3116	.0000
22.605	-.7522	12.1064	.0045	1.0000	45.0908	.0000
24.450	-.7849	13.9481	.0005	.9998	5.0105	.0000
26.295	-.8100	15.7932	.0000	.9940	.0005	.0000