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A Stochastic Model for Estimation of Mean and Variance of Time to Recruitment in a Two Graded Manpower System under Order Statistics Wastage with Non-Identically Inter-Decision Times

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Abstract. In this paper, an organization subjected to a random exit of personnel due to policy decisions taken by the organization is considered; there is an associated loss of manpower if a person quits the organization. As the exit of personnel is unpredictable, a recruitment policy involving two thresholds, optional and mandatory is suggested to enable the organization to plan its decision on appropriate univariate policy of recruitment. Based on shock model approach, a mathematical model is constructed using an appropriate univariate policy of recruitment. The analytical expressions for mean and variance of time to recruitment is obtained when (i) the loss of man hours forms an order statistics (ii) the inter-decision times are sequence of independent and non-identically distributed exponential random variables (iii) the optional and mandatory thresholds having exponential distribution.

Keywords: Manpower planning, shock models, univariate recruitment policy, hypo-exponential distribution, order statistics.

AMS Mathematics Subject Classification (2010): 90B70, 60H30, 60K05

1. Introduction

Exit of personnel which is in other words known as wastage is an important aspect in the study of man power planning. Many models have been discussed using different kinds of wastages and different types of distributions. In [5], for a single grade man power system with a mandatory exponential threshold for the loss of man power, the authors have obtained the system performance measures namely mean and variance of the time to recruitment when the inter-decision times form an order statistics. Since the number of exits in every policy decision-making epoch is unpredictable and the time at which the cumulative loss of man-hours crossing a single threshold is probabilistic, the organization has left with no choice except making recruitment immediately upon threshold crossing. In [2], for a single grade man power system, the author has introduced the concept of alertness in the recruitment policy which involves two thresholds – one is optional and the other is mandatory and obtained mean and variance of the time to recruitment under different conditions. In [8,9,10], for a two grade man power system involving optional and mandatory thresholds, the authors have obtained mean and variance of time to recruitment according as the thresholds are exponential random variable or geometric random variable and extended exponential random variable when the inter-decision times form an order statistics. In [3], the authors have studied the system characteristics using different univariate policies of recruitment and by assuming different types of thresholds and wastages.

Recently in [6], the authors have obtained mean and variance of time to recruitment for a two graded manpower system with a univariate policy of recruitment involving (i) the loss of manpower and inter-decisions times are independent and non-identically distributed exponential random variables (ii) thresholds optional and mandatory follows exponential random variables. In [7], the authors have obtained mean and variance of time to recruitment for a two graded manpower system with a univariate policy of recruitment involving (i) the loss of man hours are independent and non-identically distributed exponential random variables (ii) the inter-decisions times are exchangeable and constantly correlated (iii) thresholds optional and mandatory follows exponential random variables.

The objectives of the present paper is to study the problem of time to recruitment for a two graded manpower systems and to obtain the mean and variance of time to recruitment using CUM univariate recruitment policy for exponential thresholds with loss of manpower having order statistics and the inter-decision times having independent and non-identically distributed exponential random variables. The analytical results are numerically illustrated and the influence of nodal parameters on the mean and variance of time to recruitment is studied.

2. Notations

X_i : The loss of man hours due to the ith decision epoch i=1,2,3…forming an order statistics with parameter α. $X_{(1)},X_{(2)},X_{(3)}, \ldots X_{(n)}$ are the order statistics selected from the sample $X_1,X_2,X_3, \ldots X_n$ respectively with $X_{(1)} \leq X_{(2)} \leq X_{(3)} \leq \cdots \quad X_{(n)}$

$G_k(.)$: The distribution function of X_i

$g_k(.)$: The probability density function of X_i

$X_{(1)}$: The smallest order Statistic

$g_{x(1)}$: Probability density function of $U_{(1)}$

$X_{(n)}$: The largest order Statistic

$G_{x(n)}$: Probability density function of $U_{(m)}$

U_k :A continuous random variables denoting the inter-decision times between (k 1)th and kth decisionepochs, k=1,2,3…forming a sequence of independent and non-identically distributed exponentialrandom variables with parameters α_i, (α_i>0).

$F_k(.)$: Probability distribution function of U_k .

$f_k(.)$: Probability density function of U_k

Y_1, Y_2 : The continuous random variables denoting the optional thresholds levels for the grade 1 and grade 2 follows exponential distribution with parameters λ_1, λ_2 respectively.

Max Y = Max (Y_1, Y_2)

Z_1, Z_2 : The continuous random variables denoting the mandatory thresholds levels for the grade 1 and grade 2 follows exponential distribution with parameters μ_1, μ_2 respectively.

Max Z = Max (Z_1, Z_2)

W : The continuous random variable denoting the time to recruitment in the organization.
p : The probability that the organization is not going for recruitment whenever the total loss ofman-hours crosses the optional threshold Y.
$V_k(t)$: The probability that exactly k-decisions are taken in [0, t)
L(.) : Distribution function of W
l (.) : The probability density function of W
$l^*(.)$: The Laplace transform of l(.)
E(W) : The expected time to recruitment
V(W) : The variance of the time to recruitment
CUM policy: Recruitment is done whenever the cumulative loss of manpower crosses the mandatory threshold. The organization may or may not go for recruitment if the cumulative loss of manpower crosses the optional threshold.

3. Main results

Analytical results for the above cited measures related to time to recruitment, we are derived for the present model. The survival function of W is given by

$$P(W>t) = \sum_{k=0}^{\infty} V_k(t)\, P(S_k<Y) + \sum_{k=0}^{\infty} V_k(t)\, P(S_k\geq Y)\, P(S_k<Z)\, p \qquad (1)$$

For maximum model, we get

$$P(S_k<Y) = \int_0^{\infty} P(S_k < Y \mid S_k = x)\, g_k(x)\, dx$$

$$= g_k^*(\lambda_1)+g_k^*(\lambda_2) - g_k^*(\lambda_1+\lambda_2) \qquad (2)$$

$$P(S_k<Y) = D_1 + D_2 - D_3 \qquad (3)$$

Similarly,

$$P(S_k<Z) = g_k^*(\mu_1)+g_k^*(\mu_2) - g_k^*(\mu_1+\mu_2) \qquad (4)$$

$$P(S_k<Y) = D_4 + D_5 - D_6 \qquad (5)$$

where $D_1 = g_k^*(\lambda_1)$, $D_2 = g_k^*(\lambda_2)$, $D_3 = g_k^*(\lambda_1+\lambda_2)$,

$D_4 = g_k^*(\mu_1)$, $D_5 = g_k^*(\mu_2)$, $D_6 = g_k^*(\mu_1+\mu_2)$

Substitute equations (3) and (5) in equation (1), we get,

$$P(W>t) = \sum_{k=0}^{\infty} V_k(t)\{(D_1+D_2-D_3)\big(1-p(D_4+D_5-D_6)\big)+p(D_4+D_5-D_6) \qquad (6)$$

$$P(W>t) = \sum_{k=0}^{\infty} V_k(t)\{B_k(1-pC_k)+pC_k \qquad (7)$$

$$P(W>t) = \sum_{k=0}^{\infty} V_k(t)\, A_k \text{ where } A_k = B_k(1-pC_k) + pC_k \quad (8)$$

where $B_k = D_1 + D_2 - D_3$ and $C_k = D_4 + D_5 - D_6$

From renewal theory

$$V_k(t) = F_k(t) - F_{k+1}(t) \;\&\; F_o(t) = 1$$

$$P(W>t) = \sum_{k=0}^{\infty} [F_k(t) - F_{k+1}(t)]A_k$$

$$= \sum_{k=0}^{\infty} F_k(t)A_k - \sum_{k=0}^{\infty} F_{k+1}(t)A_k$$

$$L(t) = 1-P(W>t) = 1+\sum_{k=0}^{\infty} F_{k+1}(t)A_k - \sum_{k=0}^{\infty} F_k(t)A_k$$

We note that $\frac{d}{dt}L(t) = l(t)$ and laplace transform of $l(t)= l^*(s)$, we get

$$l(t) = \sum_{k=0}^{\infty} f_{k+1}(t)A_k - \sum_{k=0}^{\infty} f_k(t)A_k$$

$$l(t) = \sum_{k=0}^{\infty} f_{k+1}^*(s)A_k - f_k^*(s)A_k$$

$$l^*(s) = \sum_{k=0}^{\infty} f_{k+1}^*(s)A_k - \sum_{k=0}^{\infty} f_k^*(s)A_k \quad (9)$$

where

$$A_k = [g_k^*(\lambda_1)+g_k^*(\lambda_2) - g_k^*(\lambda_1+\lambda_2)][1-p(g_k^*(\mu_1)+g_k^*(\mu_2) - g_k^*(\mu_1+\mu_2))]$$
$$+p[(g_k^*(\mu_1)+g_k^*(\mu_2) - g_k^*(\mu_1+\mu_2)] \quad (10)$$

It is known that

$$E(W) = -\left[\frac{d}{ds} l^*(s)\right]_{s=0} \quad (11)$$

$$E(W^2) = \left[\frac{d^2}{ds^2} l^*(s)\right]_{s=0} \quad (12)$$

$$Var(W) = E(W^2) - (E(W))^2 \quad (13)$$

Assume that the wastage form the population $\{X_i\}$ follows order statistics

$G(t)= 1-e^{-\alpha t}$, $g(t)= \alpha e^{-\alpha t}$.

Let $\{X_i\}$ i=1,2,3….n be a sample of size n selected fro this population. The random variables $X_{(1)},X_{(2)},X_{(3)}, \ldots X_{(n)}$ are not independent. For r=1,2,3…n, the probability density function of X(n) is given by

$$g_{x(i)}(t) = i(nC_i)\big(G(t)\big)^{i-1} g(t)(1-G(t))^{n-i}, \text{ i=1,2,3….n , where } g(t)= G^1(t) \qquad (14)$$

Case (i):

Suppose $g(t)= g_{x(1)}(t)$

From the Equation (14), we get $g_{x(1)}(t) = n\alpha e^{-n\alpha t}$, $g^*(s)= g_{x(1)}{}^*(s)=\frac{n\alpha}{n\alpha+s}$ (15)

Using the above result in A_k, we get

$$g_{x(1)}{}^*(\lambda_1)=\frac{n\alpha}{n\alpha+\lambda_1} = M_1 ,\ g_{x(1)}{}^*(\lambda_2)=\frac{n\alpha}{n\alpha+\lambda_2} = M_2 ,\ g_{x(1)}{}^*(\lambda_1+\lambda_2)=\frac{n\alpha}{n\alpha+\lambda_1+\lambda_2} = M_3 \qquad (16)$$

Similarly

$$g_{x(1)}{}^*(\mu_1)=\frac{n\alpha}{n\alpha+\mu_1} = M_4 ,\ g_{x(1)}{}^*(\mu_2)=\frac{n\alpha}{n\alpha+\mu_2} = M_5 ,\ g_{x(1)}{}^*(\mu_1+\mu_2)=\frac{n\alpha}{n\alpha+\mu_1+\mu_1} = M_6 \qquad (17)$$

Substituting the equations (16) and (17) in (10), we get

$A_k = [M_1 + M_2 - M_3][1-p(M_4+M_5 - M_6)]+ p\,[M_4+M_5 - M_6]$

Inter-decision times follows hypo-exponential distribution, the probability density function is

$f_k(t) = \sum_{i=1}^{k} b_i \beta_i e^{-\beta_i t}$ and the Laplace transform is

$$f_k^*(s) = \sum_{i=1}^{k} b_i \frac{\beta_i}{\beta_i+s} \quad \text{where } b_i = \prod_{\substack{j=1\\ j\neq i}}^{k} \frac{\beta_j}{\beta_j-\beta_i}, i=1,2\ldots k \qquad (18)$$

Substituting the equation (18) in (9), we get

$$l^*(s) = \sum_{k=0}^{\infty}\sum_{i=1}^{k+1} (b_i \frac{\beta_i}{\beta_i+s})A_k$$

$$\frac{d}{ds} l^*(s) = -\sum_{k=0}^{\infty}\sum_{i=1}^{k+1} \frac{\beta_i}{(\beta_i+s)^2} A_k$$

$$[\frac{d}{ds} l^*(s)]_{s=0} = -\sum_{k=0}^{\infty} \frac{1}{\beta_{k+1}} A_k$$

$$E(W)= -[\frac{d}{ds} l^*(s)]_{s=0} = \sum_{k=0}^{\infty} \frac{1}{\beta_{k+1}} A_k \qquad (19)$$

$$\left[\frac{d^2}{ds^2} l^*(s)\right] = 2\sum_{k=0}^{\infty}\sum_{i=1}^{k+1} \frac{\beta_i}{(\beta_i+s)^3} A_k$$

$$E(W^2) = \left[\frac{d^2}{ds^2} l^*(s)\right]_{s=0} = 2\sum_{k=0}^{\infty} \frac{1}{{\beta_{k+1}}^2} A_k \quad (20)$$

Where $A_k = [M_1 + M_2 - M_3][1 - p(M_4 + M_5 - M_6)] + p\,[M_4 + M_5 - M_6]$

Substituting equations (19) and (20) in (13), we get the variance of first order.

Case (ii):

Suppose $g(t) = g_{x(n)}(t)$, From the equation (14), we get

$$g_{x(n)}(t) = n\big(G(t)\big)^{n-1} g(t) \quad (21)$$

By using the fourier Transforms, we get

$$g^*_{x(n)}(s) = n\int_0^{\infty} e^{-st} \alpha\, e^{-\alpha t}(1 - e^{-\alpha t})^{n-1} dt$$

$$g^*_{x(n)}(s) = \frac{n!\alpha^n}{(s+\alpha)(s+2\alpha)(s+3\alpha)\ldots\ldots(s+n\alpha)} \quad (22)$$

Since $g^*(s) = g^*_{x(n)}(s)$, Using the equation (22) in A_k, we get

$$g^*_{x(n)}(\lambda_1) = \frac{n!\alpha^n}{(\lambda_1+\alpha)(\lambda_1+2\alpha)(\lambda_1+3\alpha)\ldots\ldots(\lambda_1+n\alpha)} = \frac{n!\alpha^n}{c_1} = M_7$$

$$g^*_{x(n)}(\lambda_2) = \frac{n!\alpha^n}{(\lambda_2+\alpha)(\lambda_2+2\alpha)(\lambda_2+3\alpha)\ldots\ldots(\lambda_2+n\alpha)} = \frac{n!\alpha^n}{c_2} = M_8$$

$$g^*_{x(n)}(\lambda_1+\lambda_2) = \frac{n!\alpha^n}{((\lambda_1+\lambda_2)+\alpha)((\lambda_1+\lambda_2)+2\alpha)((\lambda_1+\lambda_2)+3\alpha)\ldots\ldots((\lambda_1+\lambda_2)+n\alpha)} = \frac{n!\alpha^n}{c_3} = M_9$$

$$g^*_{x(n)}(\mu_1) = \frac{n!\alpha^n}{(\mu_1+\alpha)(\mu_1+2\alpha)(\mu_1+3\alpha)\ldots\ldots(\mu_1+n\alpha)} = \frac{n!\alpha^n}{c_4} = M_{10}$$

$$g^*_{x(n)}(\mu_2) = \frac{n!\alpha^n}{(\mu_2+\alpha)(\mu_2+2\alpha)(\mu_2+3\alpha)\ldots\ldots(\mu_2+n\alpha)} = \frac{n!\alpha^n}{c_5} = M_{11}$$

$$g^*_{x(n)}(\mu_1+\mu_2) = \frac{n!\alpha^n}{((\mu_1+\mu_2)+\alpha)((\mu_1+\mu_2)+2\alpha)((\mu_1+\mu_2)+3\alpha)\ldots\ldots((\mu_1+\mu_2)+n\alpha)} = \frac{n!\alpha^n}{c_6} = M_{12}$$

Using the above results in A_k , we get

$A_k = [M_7 + M_8 - M_9][1 - p(M_{10} + M_{11} - M_{12})] + p\,[M_{10} + M_{11} - M_{12}]$

From the equations (18), (19) and (20), we get

$$E(W) = \sum_{k=0}^{\infty} \frac{1}{\beta_{k+1}} A_k \quad (23)$$

$$E(W^2) = 2\sum_{k=0}^{\infty} \frac{1}{{\beta_{k+1}}^2} A_k \quad (24)$$

Substituting the equations (23) and (24) in (13), we get the variance of n^{th} order

3.1. Numerical illustrations

The analytical expressions for the performance measures namely mean and variance of time to recruitment are analyzed numerically for maximum model by varying a parameters at a time and keeping other parameters are fixed. The effect of nodal parameters of inter-decision times ($\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$)and loss of man hour α, n the number of decision epochs in (0,t] and p on the performance measures are shown in the following tables.

Case (i) :

Table 1: The parameters of inter-decision times ($\beta_1, \beta_2,\ \beta_3 \beta_4, \beta_5$) and p are fixed. The parameter of loss of man hour α and n the number of decision epochs in (0,t] are vary.$\beta_1 = 0.006, \beta_2 = 0.007,\ \beta_3 = 0.008, \beta_4 = 0.009, \beta_5 = 0.001$, p = 0.05, λ_1=1.25, λ_2=2.13, μ_1=3.2, μ_2=4.25

n/α		0.07	0.08	0.09	0.10	0.11
1	E(W)	101.8301	115.4931	128.9494	142.2034	155.2594
	V(W)	1.3143 x10^5	1.4749x10^5	1.6294x10^5	1.7780x10^5	1.9209x10^5
2	E(W)	193.2807	217.7118	241.4445	264.5069	286.9256
	V(W)	2.3179x10^5	2.5577x10^5	2.7792x10^5	2.9836x10^5	3.1722x10^5
3	E(W)	275.7950	308.1959	340.3162	370.6442	399.7790
	V(W)	3.0798x10^5	3.3459x10^5	3.5808x10^5	3.7875x10^5	3.9687x10^5
4	E(W)	350.5623	390.1959	427.7857	463.4769	497.4014
	V(W)	3.6527x10^5	3.9110x10^5	4.1270x10^5	4.3059x10^5	4.4523x10^5
5	E(W)	418.5716	463.4769	505.6208	545.2355	582.5283
	V(W)	4.0760x10^5	4.3059x10^5	4.4843x10^5	4.6196x10^5	4.7184x10^5

Findings :

From the table, we observe the following:

1. The mean and variance of time to recruitment increase as the number of decisions n and inter-decision times β are increases simultaneously.
2. If n, the number of decision epochs in (0,t] increases, while the mean and variance of time to recruitment increase .

3. As $\boldsymbol{\alpha}$, loss of man hours increase, mean and variance of time to recruitment increase and on an average loss of man hours increases.

Table 2: The parameter of loss of man hour $\boldsymbol{\alpha}$, n the number of decision epochs in (0,t] and p are fixed. The parameters of inter-decision times are (β_1, β_2, $\beta_3\beta_4$, β_5) vary.
α = 0.07, p = 0.05, n =5, λ_1=1.25, λ_2=2.13, μ_1=3.2, μ_2=4.25

β_1	β_2	β_3	β_4	β_5	**E(W)**	**V(W)**
0.006	0.007	0.008	0.009	0.001	**174.8437**	**1.6094 x 10^4**
0.008	0.007	0.008	0.009	0.001	**163.5600**	**1.3330 x 10^4**
0.012	0.007	0.008	0.009	0.001	**152.2763**	**1.2192x 10^4**
0.013	0.007	0.008	0.009	0.001	**150.5403**	**1.2161x 10^4**
0.014	0.007	0.008	0.009	0.001	**147.7628**	**1.2152x 10^4**
0.006	**0.0070**	0.008	0.009	0.001	**174.8437**	**1.6094 x 10^4**
0.006	**0.0091**	0.008	0.009	0.001	**165.9159**	**1.4623x 10^4**
0.006	**0.0092**	0.008	0.009	0.001	**165.5924**	**1.4589x 10^4**
0.006	**0.0095**	0.008	0.009	0.001	**164.6629**	**1.4498x 10^4**
0.006	**0.0097**	0.008	0.009	0.001	**164.0751**	**1.4446x 10^4**
0.006	0.007	**0.0080**	0.009	0.001	**174.8437**	**1.6094 x 10^4**
0.006	0.007	**0.0082**	0.009	0.001	**174.0180**	**1.5974x 10^4**
0.006	0.007	**0.0085**	0.009	0.001	**172.8524**	**1.5820x 10^4**
0.006	0.007	**0.0087**	0.009	0.001	**172.1200**	**1.5732x 10^4**
0.006	0.007	**0.0089**	0.009	0.001	**171.4205**	**1.5654x 10^4**
0.006	0.007	0.008	**0.0090**	0.001	**174.8437**	**1.6094 x 10^4**
0.006	0.007	0.008	**0.0093**	0.001	**173.8730**	**1.6008x 10^4**
0.006	0.007	0.008	**0.0095**	0.001	**173.2600**	**1.5960x 10^4**
0.006	0.007	0.008	**0.0097**	0.001	**172.6722**	**1.5918x 10^4**
0.006	0.007	0.008	**0.0099**	0.001	**172.1082**	**1.5882x 10^4**
0.006	0.007	0.008	0.009	**0.0010**	**418.5716**	**4.0766x 10^5**
0.006	0.007	0.008	0.009	**0.0012**	**373.4368**	**2.7792x 10^5**
0.006	0.007	0.008	0.009	**0.0014**	**341.1977**	**2.0117x 10^5**
0.006	0.007	0.008	0.009	**0.0016**	**317.0183**	**1.5232x 10^5**
0.006	0.007	0.008	0.009	**0.0018**	**298.2121**	**1.1948x 10^5**

Findings:

From the table , we observe the following:

1. As inter-decision times are increases, mean and variance of time to recruitment decreases and on an average inter-decision times increases.

Case (ii) :

Table 1: The parameters of inter-decision times ($\beta_1, \beta_2,\ \beta_3\beta_4,\beta_5$) and p are fixed. The parameter of loss of man hour α and n the number of decision epochs in (0,t] are vary.
$\beta_1 = 0.006, \beta_2 = 0.007, \beta_3 = 0.008, \beta_4 = 0.009, \beta_5 = 0.001$, p = 0.05,
λ_1=1.25, λ_2=2.13, μ_1=3.2, μ_2=4.25

n/α		0.030	0.035	0.040	0.045	0.047
1	E(W)	224.5455	260.8388	296.8191	332.4899	346.6725
	V(W)	1.0592×10^{5}	1.1357×10^{5}	1.1856×10^{5}	1.2095×10^{5}	1.2119×10^{5}
2	E(W)	6.6040	8.9214	11.5657	14.5296	15.8031
	V(W)	4.5544×10^{3}	6.1320×10^{3}	7.9189×10^{3}	9.9052×10^{3}	1.0753×10^{4}
3	E(W)	0.1938	0.3043	0.4494	0.6330	0.7181
	V(W)	134.8733	211.8013	312.6750	440.3136	499.4688
4	E(W)	0.0057	0.0104	0.0175	0.0276	0.0327
	V(W)	3.9598	7.2317	12.1637	19.2137	22.7377
5	E(W)	1.6701×10^{-4}	3.5470×10^{-4}	6.7972×10^{-4}	0.0012	0.0015
	V(W)	0.1163	0.2470	0.4733	0.8385	1.0351

Findings :

From the table , we observe the following:

1. The mean and variance of time to recruitment decrease as the number of decisions n and loss of man hours α are increases simultaneously.
2. If n, the number of decision epochs in (0,t] increases, while mean and variance of time to recruitment decrease .
3. As α, loss of man hours are increase, mean and variance of time to recruitment increase and on an average loss of man hours increases.

Table 2: The parameter of loss of man hour $\boldsymbol{\alpha}$, n the number of decision epochs in (0,t] and p are fixed. The parameters of inter-decision times are ($\beta_1, \beta_2, \beta_3\beta_4, \beta_5$) vary.
$\boldsymbol{\alpha}$ = 0.07, p = 0.05, n =2, λ_1=1.25, λ_2=2.13, μ_1=3.2, μ_2=4.25

β_1	β_2	β_3	β_4	β_5	**E(W)**	**V(W)**
0.006	0.007	0.008	0.009	0.001	**20.2721**	**1.3704x10^4**
0.008	0.007	0.008	0.009	0.001	**19.7256**	**1.3566x10^4**
0.012	0.007	0.008	0.009	0.001	**19.1791**	**1.3473x10^4**
0.013	0.007	0.008	0.009	0.001	**19.0951**	**1.3463x10^4**
0.014	0.007	0.008	0.009	0.001	**19.0230**	**1.3455x10^4**
0.006	**0.0070**	0.008	0.009	0.001	**20.2721**	**1.3704x10^4**
0.006	**0.0091**	0.008	0.009	0.001	**19.8397**	**1.3612x10^4**
0.006	**0.0092**	0.008	0.009	0.001	**19.8241**	**1.3609x10^4**
0.006	**0.0095**	0.008	0.009	0.001	**19.7791**	**1.3601x10^4**
0.006	**0.0097**	0.008	0.009	0.001	**19.7506**	**1.3596x10^4**
0.006	0.007	**0.0080**	0.009	0.001	**20.2721**	**1.3704x10^4**
0.006	0.007	**0.0082**	0.009	0.001	**20.2321**	**1.3695x10^4**
0.006	0.007	**0.0085**	0.009	0.001	**20.1757**	**1.3684x10^4**
0.006	0.007	**0.0087**	0.009	0.001	**20.1402**	**1.3677x10^4**
0.006	0.007	**0.0089**	0.009	0.001	**20.1063**	**1.3671x10^4**
0.006	0.007	0.008	**0.0090**	0.001	**20.2721**	**1.3704x10^4**
0.006	0.007	0.008	**0.0093**	0.001	**20.2251**	**1.3695x10^4**
0.006	0.007	0.008	**0.0095**	0.001	**20.1954**	**1.3690x10^4**
0.006	0.007	0.008	**0.0097**	0.001	**20.1670**	**1.3685x10^4**
0.006	0.007	0.008	**0.0099**	0.001	**20.1396**	**1.3681x10^4**
0.006	0.007	0.008	0.009	**0.0010**	**20.2721**	**1.3704x10^4**
0.006	0.007	0.008	0.009	**0.0012**	**18.0862**	**9.7799x10^3**
0.006	0.007	0.008	0.009	**0.0014**	**16.5248**	**7.4175x10^3**
0.006	0.007	0.008	0.009	**0.0016**	**15.3537**	**5.8864x10^3**
0.006	0.007	0.008	0.009	**0.0018**	**14.4429**	**4.8383x10^3**

Findings:
From the table, we observe the following:
As inter-decision times are increases, mean and variance of time to recruitment decreases and on an average loss of man hours increases.

4. Conclusion

The stochastic model under case (i) is more preferable compared to the stochastic models coming under cases (ii)of this model as the average time to recruitment is greater than the corresponding meantime to recruitment.

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