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Determination of Expected Time to Recruitment in Manpower Model using Shock Model Approach

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Abstract

In recent year mathematics and statistics have done much more work on the development of models in manpower systems .Many manpower models contribute a dominant role in efficient structure and control of manpower system. The strategic manpower planning literature is in generally divided into two approaches. Among this Stochastic process of formulation/model is one approach on the other hand is based on an optimization model. In this paper based on stochastic model to estimate the time to recruitment when the threshold depicts exponentiated modified weibul distribution

Keyword: Stochastic model , shock model , recruitment MWD..

Introduction

Manpower planning is a useful tool for human resource management in many organizations. Such manpower planning models are analytical time discrete push and pull models. The workforce planning is long-term strategic manpower planning. While in personal scheduling the available personnel is more or less fixed, the long term supply of employees in the company can be adopted to the forecast needs by recruitments, layouts or retaining wastage etc, Exists of personnel which is in otherwords known as wastage is a key aspects in the study of manpower planning. A detailed account of the application of stochastic processes in manpower planning models can be seen from Bartholomew and Morris (1971), Bartholomew and Smith (1975), Smith (1971), Bartholomew (1973), Clough *et al*., (1974), Grinold and Marshall (1977), Bartholomew and Forbes (1979) and Bennison and Casson (1984).

Wastage in manpower planning terminology refers to the leaving process of persons from an organization. It is the most fundamental concept that plays a key role in manpower planning. In fact wastage has impact upon the manpower system. Wastage arises due to individual decisions to leave the organization and is hence outside the direct control of the management. In organizations where the number of jobs is controlled it is wastage which creates vacancy and so provides opportunity for promotions and recruitments. Hence the measurement of wastage is very important for the successful formulation of manpower policies. Statistical analysis of data on wastage is found to be very useful for making policy decisions. The term wastage is also used to refer the total loss of individuals from a system for whatever reason. Wastage can be either voluntary or involuntary. Involuntary wastage arises for reasons beyond the control of individuals such as death, illness redundancy and retirement and to a large extent it is predictable and it presents few difficulties in manpower planning. On the other hand voluntary or natural wastage refers to the leaving of an individual of his own choice such as taking to another job etc., it is not predictable. The recruitment policy, promotions are all based on the extent of wastage that occur in an organization. In the study of wastage many factors are introduced and it may be noted that the Complete Length of Service (CLS) plays an important role in the study of manpower models. Forecasting the future wastage is an important aspect of manpower planning. The survivor function of reliability function is also used in the study of wastage and its measurement.

The concept of shock model and cumulative damage process is an attractive one, which helps in the interpretation of the behaviors of complex mechanisms. Any component or device exposed to shocks which cause damage to the device or system is likely to fail when the total cumulated damage exceed a level called threshold. We consider a device exposed to shocks. Suppose that shocks cause damage and the damages accumulate additively. Let the device fail when the total damage exceeds a threshold level. Assume that the damages $X_1, X_2, \dots, X_n$ caused by successive shocks are mutually independent identically distributed random variables with distribution

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function $F(\cdot)$, independent of the threshold whose distribution function is $G(\cdot)$. Then the probability that the device survives K damage is denoted as

$$P_k(x) = \int_0^{\infty} F_k(x)\,[1 - G(x)]dx, \qquad k = 1,2,3,\ldots$$

Where $F_k(x)$ is the k fold convolution of $F(x)$ with itself and $F_0(x) = 1$.
The Reliability $R(t)$ of the device is given by

$$R(t) = \sum_{k=0}^{\infty} P_k(t)\, V_k(t)$$

Where $V_k(t)$ is the probability that K damages are caused during $(0, t]$. The above model has been considered by Esary et al., (1973). Ramanarayanan (1976) has considered a cumulative damage process introducing the concept of alertness of the worker.

One can also refer Sathiyamoorthi and Parthasarathy (2003) have used the idea of change of parameter for the threshold distribution after the truncation point. Jeeva *et al.*, (2004) discussed frequent wastage or exit of personnel are common in many administrative and production oriented organizations. Here consider the threshold follows exponentiated modified weibull distribution to determine the mean and its variance with numerical example.

Assumptions of the Model

- Exit of persons from an organisation takes place whenever the policy decisions regarding targets, incentives and promotions are made.
- The exit of every person from the organisation results in a random amount of depletion of manpower (in man hours).
- The process of depletion is linear and cumulative.
- The inter arrival times between successive occasions of wastage are i.i.d. random variables.
- If the total depletion exceeds a threshold level Y which is itself a random variable, the breakdown of the organisation occurs. In other words recruitment becomes inevitable.
- The process which generates the exits the sequence of depletions and the threshold are mutually independent.

Notations

X_i : a continuous random variable denoting the amount of damage/depletion caused to the system due to the exit of persons on the ith occasion of policy announcement, i = 1, 2, …. k and X_i's are i. i.d. and X_i = X for all i {Eg. $X_i \sim \exp(\alpha)$, for all i}.

Y : a continuous random variable denoting the threshold level having EMD property.

g(.) : the probability density function of X.

$g_k(.)$: the k-fold convolution of g(.) i.e., p.d.f. of $\sum_{i=1}^{k} X_i$

T : a continuous r.v denoting time to breakdown of the system.

τ_0 : truncation point of the r.v. Y.

g*(.): Laplace transform of g(.).

g_k*(.): Laplace transform of g_k(.).

h(.) : the p.d.f. of random threshold level which has SCBZ property, and

H(.) : is the corresponding c.d.f.

U : a continuous random variable density the interarrival times between decision epochs decision epochs.

f(.) : p.d.f. of random variable corresponding c.d.f. F(.).

$F_k(t)$: the k-fold convolution function of F(.).

S(.) : the survivor function as P [T > t].

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L(t) : 1 – S(t).
$V_k(t)$: probability that there are exactly 'k' policy decisions in (0, t].

Results

Y~ exponentiated modified weibull distribution and the distribution function is H(y)

where $H(y) = \left[1 - e^{-(\theta y + \gamma y^{\beta})}\right]^{\alpha}, y > 0.$

Put α = 2 & β = 1 then,

$$\overline{H}(y) = \left[2e^{-y(\theta+\gamma)} - e^{-2y(\theta+\gamma)}\right]$$

$$P\left(X < Y\right) = \int_0^{\infty} G\left(x\right)\left[1 - e^{-(\theta y + \gamma y^{\beta})}\right]^{\alpha} dx$$

$$P\left(X_1 + X_2 + \ldots\ldots + X_k < Y\right) = \int_0^{\infty} \mathrm{g_k}\left(x\right)\overline{\mathrm{H}}\left(x\right)\mathrm{d}x$$

Now, the probability that the total antigenic diversity has not crossed the threshold level before the times 't' is given by

$$S\left(t\right) = P\left[T > t\right]$$

$$= \sum_{\mathrm{k}=0}^{\infty} \Pr\left\{\text{there are exactly k contacts in}(0,\mathrm{t}]\right\}$$

$$*Pr\left\{\text{the threshold is not crossed}\right\}$$

$$P\left(T > t\right) = \sum_{\mathrm{k}=0}^{\infty}\left[\mathrm{F_k}\left(\mathrm{t}\right) - \mathrm{F_{k+1}}\left(\mathrm{t}\right)\right]\left[\left[2\mathrm{g}*\left(\theta+\gamma\right)\right]^{\mathrm{k}} - \left[\mathrm{g}*2\left(\theta+\gamma\right)\right]^{\mathrm{k}}\right]$$

Since, $\Pr\left\{\text{there are exactly k contacts in}(0,\mathrm{t}]\right\} = \left[\mathrm{F_k}\left(\mathrm{t}\right) - \mathrm{F_{k+1}}\left(\mathrm{t}\right)\right]$, by Renewal theory

$$L\left(T\right) = P\left(T \le t\right) = 1 - \left\{\sum_{\mathrm{k}=0}^{\infty}\left[\mathrm{F_k}\left(\mathrm{t}\right) - \mathrm{F_{k+1}}\left(\mathrm{t}\right)\right]\left[\left[2\mathrm{g}*\left(\theta+\gamma\right)\right]^{\mathrm{k}} - \left[\mathrm{g}*2\left(\theta+\gamma\right)\right]^{\mathrm{k}}\right]\right\}$$

$$= 2\left[1\text{-}\mathrm{g}*\left(\theta+\gamma\right)\right]\sum_{\mathrm{k}=1}^{\infty}\mathrm{F_k}\left(\mathrm{t}\right)\left[\mathrm{g}*\left(\theta+\gamma\right)\right]^{\mathrm{k}-1} - \left[1\text{-}\mathrm{g}*2\left(\theta+\gamma\right)\right]\sum_{\mathrm{k}=1}^{\infty}\mathrm{F_k}\left(\mathrm{t}\right)\left[\mathrm{g}*2\left(\theta+\gamma\right)\right]^{\mathrm{k}-1}$$

on simplification

Differentiating w.r.to 't', we have

$$l(\mathrm{t}) = 2\left[1\text{-}\mathrm{g}*\left(\theta+\gamma\right)\right]\sum_{\mathrm{k}=1}^{\infty} f_{\mathrm{k}}\left(\mathrm{t}\right)\left[\mathrm{g}*\left(\theta+\gamma\right)\right]^{\mathrm{k}-1}$$

$$- \left[1\text{-}\mathrm{g}*2\left(\theta+\gamma\right)\right]\sum_{\mathrm{k}=1}^{\infty} f_{\mathrm{k}}\left(\mathrm{t}\right)\left[\mathrm{g}*2\left(\theta+\gamma\right)\right]^{\mathrm{k}-1}$$

Taking LaplaceStieltje'stransform, we have

$$l*\left(\mathrm{s}\right) = 2\left[1\text{-}\mathrm{g}*\left(\theta+\gamma\right)\right]\sum_{\mathrm{k}=1}^{\infty}\left[f*\left(\mathrm{s}\right)\right]^{\mathrm{k}}\left[\mathrm{g}*\left(\theta+\gamma\right)\right]^{\mathrm{k}-1} - \left[1\text{-}\mathrm{g}*2\left(\theta+\gamma\right)\right]\sum_{\mathrm{k}=1}^{\infty}\left[f*\left(\mathrm{s}\right)\right]^{\mathrm{k}}\left[\mathrm{g}*2\left(\theta+\gamma\right)\right]^{\mathrm{k}-1}$$

$$l*\left(\mathrm{s}\right) = \frac{2\left[1\text{-}\mathrm{g}*\left(\theta+\gamma\right)\right]f*\left(\mathrm{s}\right)}{\left[1-\mathrm{g}*\left(\theta+\gamma\right)f*\left(\mathrm{s}\right)\right]} - \frac{\left[1-\mathrm{g}*2\left(\theta+\gamma\right)\right]f*\left(\mathrm{s}\right)}{\left[1-\mathrm{g}*2\left(\theta+\gamma\right)f*\left(\mathrm{s}\right)\right]} \qquad \ldots\ldots (1)$$

on simplification

But the c.d.f of Z is given by

$$\mathrm{F}(\mathrm{Z}) = \beta q \sum_{\mathrm{n}=1}^{\infty} [p + q(1-\beta)]^{\mathrm{n}} \, \mathrm{G}_{\mathrm{n}+1}(\mathrm{Z})$$

The Laplace Stieltjes transform of $F(z)$ *is* $F^{*}(z)$

$$\mathrm{F}^{*}(\mathrm{s}) = \int_{0}^{\infty} \mathrm{e}^{-\mathrm{st}} \, \mathrm{dF}(\mathrm{Z})$$

$$= \beta q G^{*}(\mathrm{s}) \sum_{\mathrm{n}=0}^{\infty} \left[\left[p + q(1-\beta) \right] G_{*}(s) \right]^{n}$$

Hence,

$$\mathrm{F}^{*}(\mathrm{s}) = \frac{q\beta \mathrm{G}^{*}(\mathrm{s})}{\left[1 - \left[p + q(1-\beta)\right] G^{*}(s)\right]}$$

The p.d.f of $F^{*}(s)$ is,

$$\mathrm{F}^{*}(\mathrm{s}) = \frac{q\beta g^{*}(\mathrm{s})}{\left[1 - \left[p + q(1-\beta)\right] g^{*}(s)\right]} \qquad \text{..... (2)}$$

Assuming that g ~ exp(c), then

$$\mathrm{g}^{*}(\mathrm{s}) = \frac{\mathrm{c}}{\mathrm{c}+\mathrm{s}},$$

$$\mathrm{g}^{*\prime}(0) = -\frac{1}{\mathrm{c}} \qquad \text{and} \quad \mathrm{g}^{*\prime\prime}(0) = \frac{2}{\mathrm{c}^{2}} \qquad \text{….. (3)}$$

From equation (3)

$$\frac{\mathrm{d}f^{*}(\mathrm{s})}{\mathrm{ds}} = \frac{\left\{ q\beta\, \mathrm{g}^{*\prime}(\mathrm{s}) \left[1 - \left[p + q(1-\beta)\right] \mathrm{g}^{*}(\mathrm{s})\right] - \left[-\left[p + q(1-\beta)\right] \mathrm{g}^{*\prime}(\mathrm{s}) \right] q\beta \;\, \mathrm{g}^{*}(\mathrm{s}) \right\}}{\left[1 - \left[p + q(1-\beta)\right] \mathrm{g}^{*}(\mathrm{s})\right]^{2}}$$

$$f^{*\prime}(s) = \frac{\left\{ q\beta\, \mathrm{g}^{*\prime}(\mathrm{s}) \left[1 - \left[p + q - q\beta\right] \mathrm{g}^{*}(\mathrm{s})\right] + \left[\left[p + q - q\beta\right] \mathrm{g}^{*\prime}(\mathrm{s}) \right] q\beta \;\, \mathrm{g}^{*}(\mathrm{s}) \right\}}{\left[1 - \left[p + q - q\beta\right] \mathrm{g}^{*}(\mathrm{s})\right]^{2}}$$

$$\left.\frac{df^{*}(s)}{ds}\right|_{s=0} = \frac{\left\{ q\beta\, \mathrm{g}^{*\prime}(0) \left[1 - \left[p + q - q\beta\right] \mathrm{g}^{*}(0)\right] + \left[\left[p + q - q\beta\right] \mathrm{g}^{*\prime}(0) \right] q\beta \;\, \mathrm{g}^{*}(0) \right\}}{\left[1 - \left[p + q - q\beta\right] \mathrm{g}^{*}(0)\right]^{2}}$$

$$= \left(\frac{q\beta \mathrm{g}^{*\prime}(0)}{(q\beta)^{2}} \right) \quad = \frac{\mathrm{g}^{*\prime}(0)}{q\beta}$$

$$f^{*\prime}(0) = \frac{-1}{cq\beta} \qquad \text{..... (4)}$$

Therefore

$$-\frac{\mathrm{d}l^{*}(\mathrm{s})}{\mathrm{ds}} = -\left\{ \frac{2\left\{ \begin{array}{l} \left[1 - \mathrm{g}^{*}(\theta+\gamma)\right] f^{*}(\mathrm{s}) \left[\left[1 - \mathrm{g}^{*}(\theta+\gamma)\right] f^{*\prime}(\mathrm{s})\right] \\ \qquad - \left[1 - \mathrm{g}^{*}(\theta+\gamma)\right] f^{*}(\mathrm{s}) \left[0 - \mathrm{g}^{*}(\theta+\gamma)\right] f^{*\prime}(\mathrm{s}) \end{array} \right\}}{\left[1 - \mathrm{g}^{*}(\theta+\gamma) f^{*}(\mathrm{s})\right]^{2}} \right.$$

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$$-\left\{\frac{\left[1\text{-}g^*2(\theta+\gamma)\right]f^*(s)\left[\left[1-g^*2(\theta+\gamma)\right]f^{*\prime}(s)\right]-\left[1-g^*2(\theta+\gamma)\right]f^*(s)\left[0-g^*2(\theta+\gamma)\right]f^{*\prime}(s)}{\left[1-g^*2(\theta+\gamma)f^*(s)\right]^2}\right\}$$

$$=-\left\{\left\{\frac{\left[2\left[1\text{-}g^*(\theta+\gamma)\right]f^{*\prime}(s)\right]}{\left[1-g^*(\theta+\gamma)f^*(s)\right]^2}\left[1-g^*(\theta+\gamma)f^*(s)+g^*(\theta+\gamma)f^*(s)\right]\right\}\right.$$

$$\left.-\left\{\frac{\left[\left[1-g^*2(\theta+\gamma)\right]f^{*\prime}(s)\right]}{\left[1-g^*2(\theta+\gamma)f^*(s)\right]^2}\left[1-g^*2(\theta+\gamma)f^*(s)+g^*2(\theta+\gamma)f^*(s)\right]\right\}\right\}$$

$$=-\left\{\frac{\left[2\left[1\text{-}g^*(\theta+\gamma)\right]f^{*\prime}(s)\right]}{\left[1-g^*(\theta+\gamma)f^*(s)\right]^2}-\frac{\left[1-g^*2(\theta+\gamma)\right]f^{*\prime}(s)}{\left[1-g^*2(\theta+\gamma)f^*(s)\right]^2}\right\}$$

on simplification

$$-\left.\frac{df^*(s)}{ds}\right|_{s=0}=-\left\{\frac{2\left[1\text{-}g^*(\theta+\gamma)\right]f^{*\prime}(0)}{\left[1-g^*(\theta+\gamma)f^*(0)\right]^2}-\frac{\left[1-g^*2(\theta+\gamma)\right]f^{*\prime}(0)}{\left[1-g^*2(\theta+\gamma)f^*(0)\right]^2}\right\} \qquad \text{..... (5)}$$

Let $g^*(\lambda)=\dfrac{\mu}{\mu+\theta+\gamma},\ g^*(2\lambda)=\dfrac{\mu}{\mu+2\theta+2\gamma}$ ...... (6)

Substituting equation (4) and (6) in (5) we get

$$E(T)=\frac{2\left[1-\dfrac{\mu}{\mu+\theta+\gamma}\right]\left[\dfrac{-1}{cq\beta}\right]}{\left[1-\dfrac{\mu}{\mu+\theta+\gamma}\right]^2}-\frac{\left[1-\dfrac{\mu}{\mu+2\theta+2\gamma}\right]\left[\dfrac{-1}{cq\beta}\right]}{\left[1-\dfrac{\mu}{\mu+2\theta+2\gamma}\right]^2}$$

$$E(T)=\frac{3\mu+2(\theta+\gamma)}{2cq\beta(\theta+\gamma)} \qquad \text{..... (7)}$$

$$\frac{d^2f^*(s)}{ds^2}=\left\{\frac{\begin{array}{l}\left[[1-[p+q-q\beta]g^*(s)\right]^2\left\{\begin{array}{l}[1-[p+q-q\beta]g^*(s)]qg^{*\prime\prime}(s)+qg^{*\prime}(s)[-[p+q-q\beta]g^{*\prime}(s)]\\ +qg^*(s)[p+q-q\beta]g^{*\prime\prime}(s)+[p+q-q\beta]g^{*\prime}(s)qg^{*\prime}(s)\end{array}\right\}\\ -\left[[1-[p+q-q\beta]g^*(s)]qg^{*\prime}(s)+qg^*(s)[p+q-q\beta]g^{*\prime}(s)\right]2[1-[p+q-q\beta]g^*(s)]\\ \left[-[p+q-q\beta]g^*(s)\right]\end{array}}{\left[1-[p+q-q\beta]g^*(s)\right]^4}\right\}$$

$$\left.\frac{d^2f^*(s)}{ds^2}\right|_{s=0}=\frac{g^{*\prime\prime}(0)}{q\beta}+\frac{2\left[p+q-\beta q\right]\left[g^{*\prime}(0)\right]^2}{(q\beta)^2} \qquad \text{..... (8)}$$

on simplification

$$g^{*\prime}(0)=\frac{-1}{c}\ \text{ and }\ g^{*\prime\prime}(0)=\frac{2}{c^2} \qquad \text{..... (9)}$$

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Substituting equation (3) in (8) we get

$$f^{*\prime\prime}(0)=\frac{2}{c^2 q\beta}+\frac{2\left[p+q-q\beta\right]}{(cq\beta)^2}$$

$$E(T^2)=\left.\frac{d^2 l^*(s)}{ds^2}\right|_{S=0}$$

$$=\frac{2\left\{\left[1\text{-}g^*(\theta+\gamma)f^*(s)\right]^2\left[1-g^*(\theta+\gamma)\right]f^{*\prime\prime}(s)-2\left[\begin{array}{c}1-g^*(\theta+\gamma)f^{*\prime}(s)\left[1-g^*(\theta+\gamma)\right]f^*(s)\\ \left[0-g^*(\theta+\gamma)f^{*\prime}(s)\right]\end{array}\right]\right\}}{\left[1-g^*(\theta+\gamma)f^*(s)\right]^4}$$

$$-\frac{\left\{\left[1\text{-}g^*2(\theta+\gamma)f^*(s)\right]^2\left[1-g^*2(\theta+\gamma)\right]f^{*\prime\prime}(s)-2\left[\begin{array}{c}1-g^*2(\theta+\gamma)f^{*\prime}(s)\left[1-g^*2(\theta+\gamma)\right]f^*(s)\\ \left[0-g^*2(\theta+\gamma)f^{*\prime}(s)\right]\end{array}\right]\right\}}{\left[1-g^*2(\theta+\gamma)f^*(s)\right]^4}$$

$$\left.\frac{d^2 l^*(s)}{ds^2}\right|_{s=0}=\frac{2\left\{\left[1\text{-}g^*(\theta+\gamma)f^*(0)\right]^2\left[1-g^*(\theta+\gamma)\right]f^{*\prime\prime}(0)+2\left[1-g^*(\theta+\gamma)\right]^2\left[f^{*\prime}(0)\right]^2 f^*(0)g^*(\theta+\gamma)\right\}}{\left[1-g^*(\theta+\gamma)f^*(0)\right]^4}$$

$$-\frac{\left\{\left[1\text{-}g^*2(\theta+\gamma)f^*(0)\right]^2\left[1-g^*2(\theta+\gamma)\right]f^{*\prime\prime}(0)+2\left[1-g^*2(\theta+\gamma)\right]^2\left[f^{*\prime}(0)\right]^2 f^*(0)g^*2(\theta+\gamma)\right\}}{\left[1-g^*2(\theta+\gamma)f^*(0)\right]^4}$$

$$=2\left\{\frac{\left[1\text{-}g^*(\theta+\gamma)\right]^2\left[1-g^*(\theta+\gamma)\right]\left[\frac{g^{*\prime\prime}(0)}{q}+\frac{2\left[1\text{-}\beta q\right]\left[g^{*\prime}(0)\right]^2}{q^2}\right]+2\left[1-g^*(\theta+\gamma)\right]^2\left[\frac{g^{*\prime}(0)}{q}\right]g^*(\theta+\gamma)^2}{\left[1-g^*(\theta+\gamma)\right]^4}\right\}$$

$$-\left\{\frac{\left[1\text{-}g^*2(\theta+\gamma)\right]^2\left[1-g^*2(\theta+\gamma)\right]\left[\frac{g^{*\prime\prime}(0)}{q}+\frac{2\left[1\text{-}\beta q\right]\left[g^{*\prime}(0)\right]^2}{q^2}\right]+2\left[1-g^*2(\theta+\gamma)\right]^2\left[\frac{g^{*\prime}(0)}{q}\right]g^*2(\theta+\gamma)^2}{\left[1-g^*2(\theta+\gamma)\right]^4}\right\} \quad \text{..... (10)}$$

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Substituting equation (6) and (9) in equation (10) we get

$$=2\left\{\frac{\left[1-\frac{\mu}{\mu+\theta+\gamma}\right]\left[\frac{2}{c^2q\beta}+2(1-q\beta)\frac{1}{(cq\beta)^2}\right]+\frac{2}{(cq\beta)^2}\left[\frac{\mu}{\mu+\theta+\gamma}\right]}{\left(\frac{\theta+\gamma}{\mu+\theta+\gamma}\right)^2}\right\}$$

$$-\left\{\frac{\left[1-\frac{\mu}{\mu+2\theta+2\gamma}\right]\left[\frac{2}{c^2q\beta}+2(1-q\beta)\frac{1}{(cq\beta)^2}+\frac{2}{(cq\beta)^2}\left[\frac{2\mu}{\mu+2\theta+2\gamma}\right]\right]}{\left(\frac{2(\theta+\gamma)}{\mu+2(\theta+\gamma)}\right)^2}\right\}$$

$$=\frac{8(\theta+\gamma)^2+14\mu^2+24\mu(\theta+\gamma)+8\theta\gamma}{4c^2q^2\beta^2(\theta+\gamma)^2}$$

on simplification

$$V(T)=\frac{5\mu^2+4(\theta+\gamma)^2+12\,\mu(\theta+\gamma)+8\theta\gamma}{4c^2q^2\beta^2(\theta+\gamma)^2}$$

on simplification

Numerical Illustrations

Table 1

c	γ = 0.5, θ = 0.2, μ=0.2, q = 0.5, β=0.4	
	Mean	Variance
1	7.14286	59.1837
2	3.57143	14.7959
3	2.38095	6.57596
4	1.78571	3.69898
5	1.42857	2.36735
6	1.19048	1.64399
7	1.02041	1.20783
8	0.89286	0.92475
9	0.79365	0.73066
10	0.71429	0.59184

Figure - 1

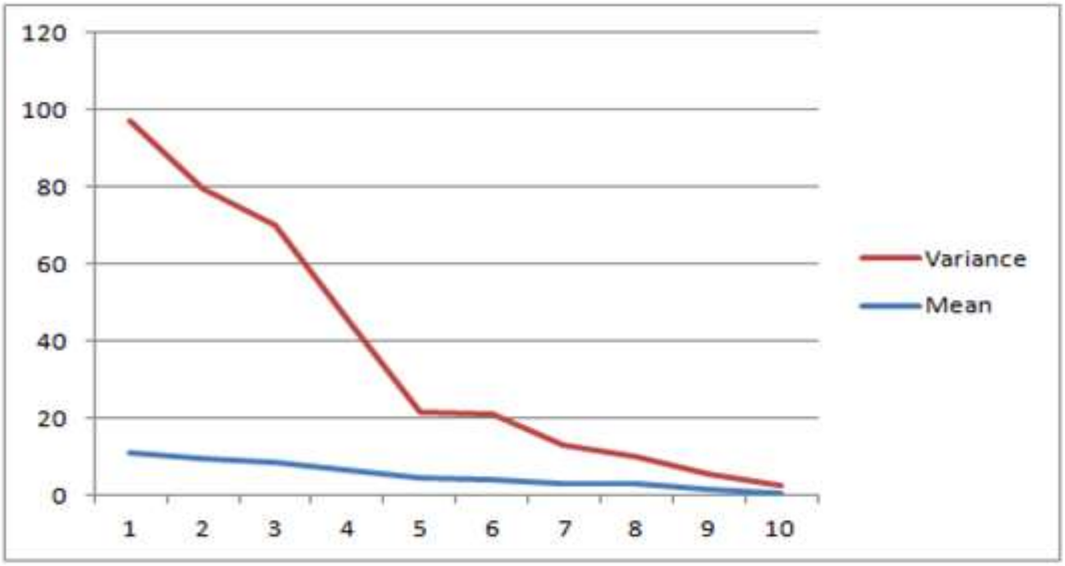

Table 2

μ	γ = 0.5, θ = 0.2, c=2, q = 0.5,β=0.4	
	Mean	Variance
0.1	3.03571	11.6390
0.2	3.57143	14.7959
0.3	4.10714	18.2717
0.4	4.64286	22.0663
0.5	5.17857	26.1799
0.6	5.71429	30.6122
0.7	6.25000	35.3635
0.8	6.78571	40.4337
0.9	7.32143	45.8227
1	7.85714	51.5306

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Figure - 2

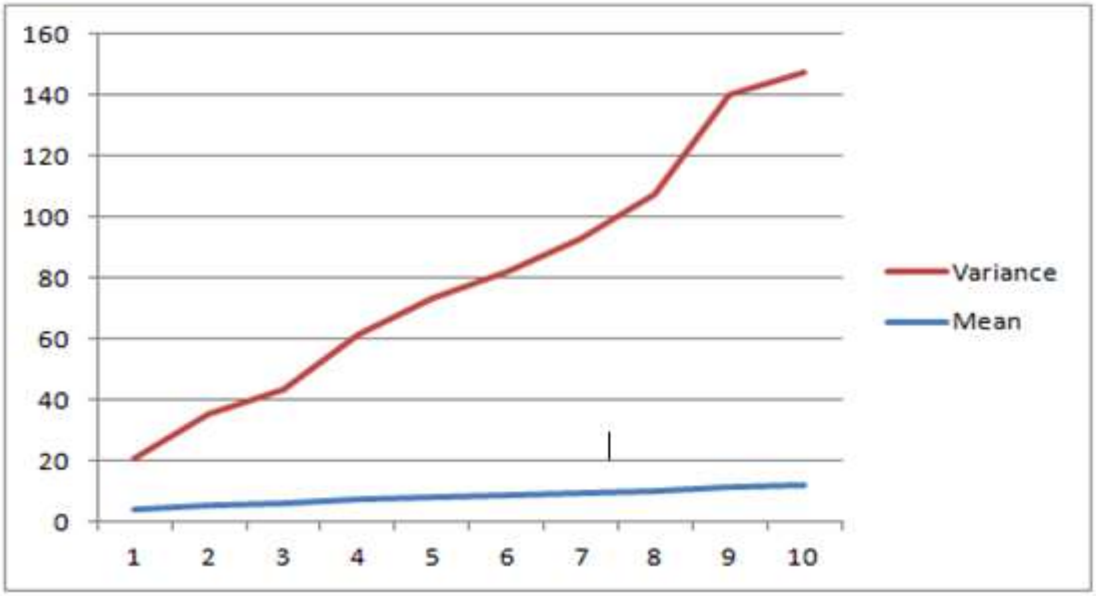


Table 3

θ	$\gamma = 0.5$, $c = 2$, $\mu=0.2$, $q = 0.5$, $\beta=0.4$	
	Mean	Variance
0.1	3.75000	15.1042
0.2	3.57143	14.7959
0.3	3.43750	14.3555
0.4	3.33333	13.8889
0.5	3.25000	13.4375
0.6	3.18182	13.0165
0.7	3.12500	12.6302
0.8	3.07692	12.2781
0.9	3.03571	11.9579
1	3.00000	11.6667

Figure - 3

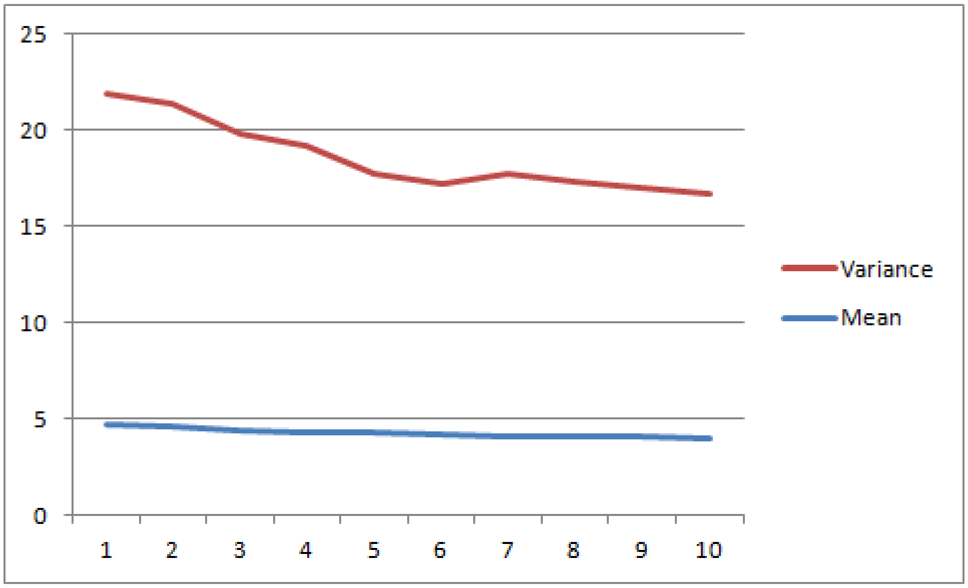
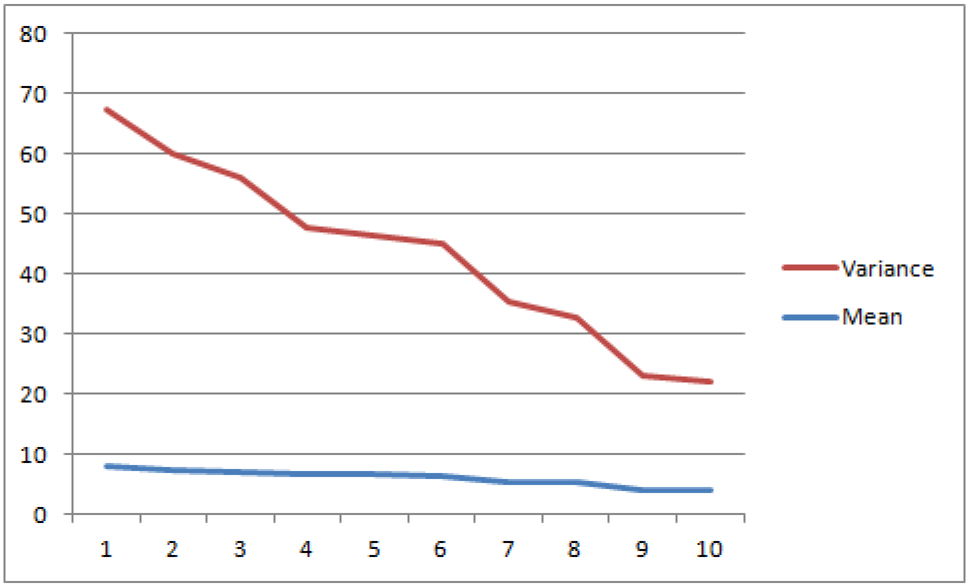


Table 4

γ	θ= 0.5, c = 2, μ=0.2, q = 0.5, β=0.4	
	Mean	Variance
0.1	5.00000	25.0000
0.2	4.37500	20.7031
0.3	4.00000	18.0000
0.4	3.75000	16.1458
0.5	3.57143	14.7959
0.6	3.43750	13.7695
0.7	3.33333	12.9630
0.8	3.25000	12.3125
0.9	3.18182	11.7769
1	3.12500	11.3281

Figure - 4



Conclusions

i) In Table 1 as the value c which is the parameter of the distribution of interval time, which is then there is corresponding decreasing exponentially distributed increases, $\frac{1}{c}$ decreases in $E(T)\&V(T)$ and it's shown in Figure-1.

ii) As the value of μ which is normally the parameter of the random variable X_i denoting contribution to the amount ofdamage increases then it is seen that $E(T)\&V(T)$ both increase as indicated in Table 2 and seen in Figure-2.

iii) From Table-3 the variation of $E(T)\&V(T)$ consequent to the changes in parameter θ is noted. As the parameter of the threshold distribution θ increases, then time decreases which can shown in Figure-3.

iv) If γ which is the parameter of the distribution the threshold increases, then $E(T)\&V(T)$ are decreases this is indicated in table 4 and figure 4.

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