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RELIABILITY AND VALIDITY ANALYSIS ON MODEL FOR REDUCING THE WEIGHT AND LOAD ON PRODUCTION SERVER

***Abstract**: We describe Weibull reliability analysis on the model for weight and load reduction on the production server database for the mobile service transactions. We study report queries for which important load and weight of database. We study concept of load balancing of database queries and conceptually determine transaction replication to the reporting server database before purging in the conceptual model, which allow load balancing of the query and free space for the new transactions.*

***Key words**: Reliability; Production Database; Reporting Database; 3P-Weibul, BX% Life, MTTF, MTBF.*
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1. Introduction

The reliability of any system can be calculated as the probability to perform its purpose for a certain period of time in the specified environment [1,2]. Computation of reliability with simulation automated tools is popular, computation tools such as Weibull++ [3], which supports large base size and helps in controlling errors in computations. In this paper, we focus on the Reliability and load balancing of the Production server database and on managing and querying problem in the database. Different lifetime distribution representations have been used in Weibull++ to check which distribution perfectly fit for the data we have entered.

3P-Weibull is implemented on “model for reducing weight and load on production server database” [5] OLTP database is critical in reports extraction; OLTP database handles weight of transactions and load of reports. In this model we have demonstrated weight reduction of old transactions and load of reports on production server by making the reporting server capable enough to handle reports by replicating data on reporting server (OLAP). As the data is available on reporting server we can now remove (Purge) some of the old data from production server database (OLTP), this task has been completed by partitioning the table and removal of partition and adding new partition, more space is free on the OLTP server for the new transactions and will increase the performance [5,9,10,11,12,13]. Our model used asynchronous mode of replication operation. The transactions first stored in the production server database and according to the server load the data will be replicated to the reporting server database [14]. We can adjust peak and non-peak hours of the database to increase and decrease the speed of the replication, this lead us to load reduction during peak hours. The reports can be extracted from the reporting server database without increasing any load on production server database [6].

2. Objective

This paper is designed to show the test of Reliability on the “Model for reducing weight and load on Production server database” [5] using 3P-Weibull distribution method. We compute Probability of Failure, BX% Life, Mean Life MTTF

[2] and Failure Rate by using Weibull++ software's 3P-Weibull distribution method for the reliability.

3. Minimum Reliability Test – Success Run Basic Properties

In order to calculate reliability, tests are conducted with the sample data, now the question arises how high is the probability P_A that a test sample falls during the test as per the literature [7, 8]:

$P_A = 1 - R_t^n$ Where R_t= Reliability at test time *t* for test sample; *n* = number of test specimen

Rearranging the formula:

$$R_t = (1 - P_A)^{\frac{1}{n}} \tag{1}$$

The reliability for the test t "time" is calculated:

$$R_t = e^{-\left(\frac{t}{T}\right)^b} \tag{2}$$

Reliability R_a applies to the defined service life t_a:

$$R_a = e^{-\left(\frac{ta}{T}\right)^b} \tag{3}$$

Equating the two relationships and defining $L_v = {}^{t}/_{t_a}$ results in:

$$\frac{R_t}{R_a} = \frac{e^{-\left(\frac{t}{T}\right)^b}}{e^{-\left(\frac{ta}{T}\right)^b}} \rightarrow \frac{\ln(R_t)}{\ln(R_a)} = \frac{-\left(\frac{t}{T}\right)^b}{-\left(\frac{ta}{T}\right)^b} = Lv^b \tag{4}$$

As a result:

$$\ln(R_t) = \ln(R_a)\, Lv^b \tag{5}$$

$$R_t = R_a^{Lv^b}$$

Together with the number of test specimens $R_t = (1 - P_A)^{\frac{1}{n}}$ and equating results in:

$$R_t = R_a^{L_v^b} = (1 - P_A)^{\frac{1}{n}} \tag{6}$$

$$R_a = (1 - P_A)^{\frac{1}{nL_v^b}}$$

The reliability R_a taken as the "guaranteed minimum reliability" and applies the following:

$$R_{min} = (1 - P_A)^{\frac{1}{nL_v^b}} \tag{7}$$

4. 3-PWeibull and Sample Data from Model

The reliability estimation on "model for reducing weight and load on production server database" [8, 5], 3P-Weibull reliability analysis with setting MLE (Maximum Likelihood), LRB (likelihood ratio) and K-M (Kaplan – Meier) [4].

In the Table 1 we have shown the results of 3P-Weibull Parameters for the Reliability, Probability of Failure, BX% Life, Mean Life and failure Rate.

Table 1

3P-Weibull Parameters with Results.

3P-Weibull Parameters	Results
Reliability	R(t=100) = 0.905036
Prob. of Failure	Q(t=100) = 0.094964
BX% Life	B10% Life = 104.305977
Mean Life	MTTF = 735.254298
Fail. Rate	Failure Rate = 0.001294

Table 2

3P-Weibull standard folio.

Last Inspected (HR)	State F or S	Time to F or S (Hr)	Subset ID
1	F	120	1
1	S	120	1
121	F	240	2
121	S	240	2
240	F	480	3
240	S	480	3
480	F	960	4
480	S	960	4

Figure 1 gives an illustration of the Reliability vs. Time. With these number of samples collected from our model we have seen that the number of failures decrease by the increase of the usage of our model. 3P-Weibull standard folio shown in Table 2

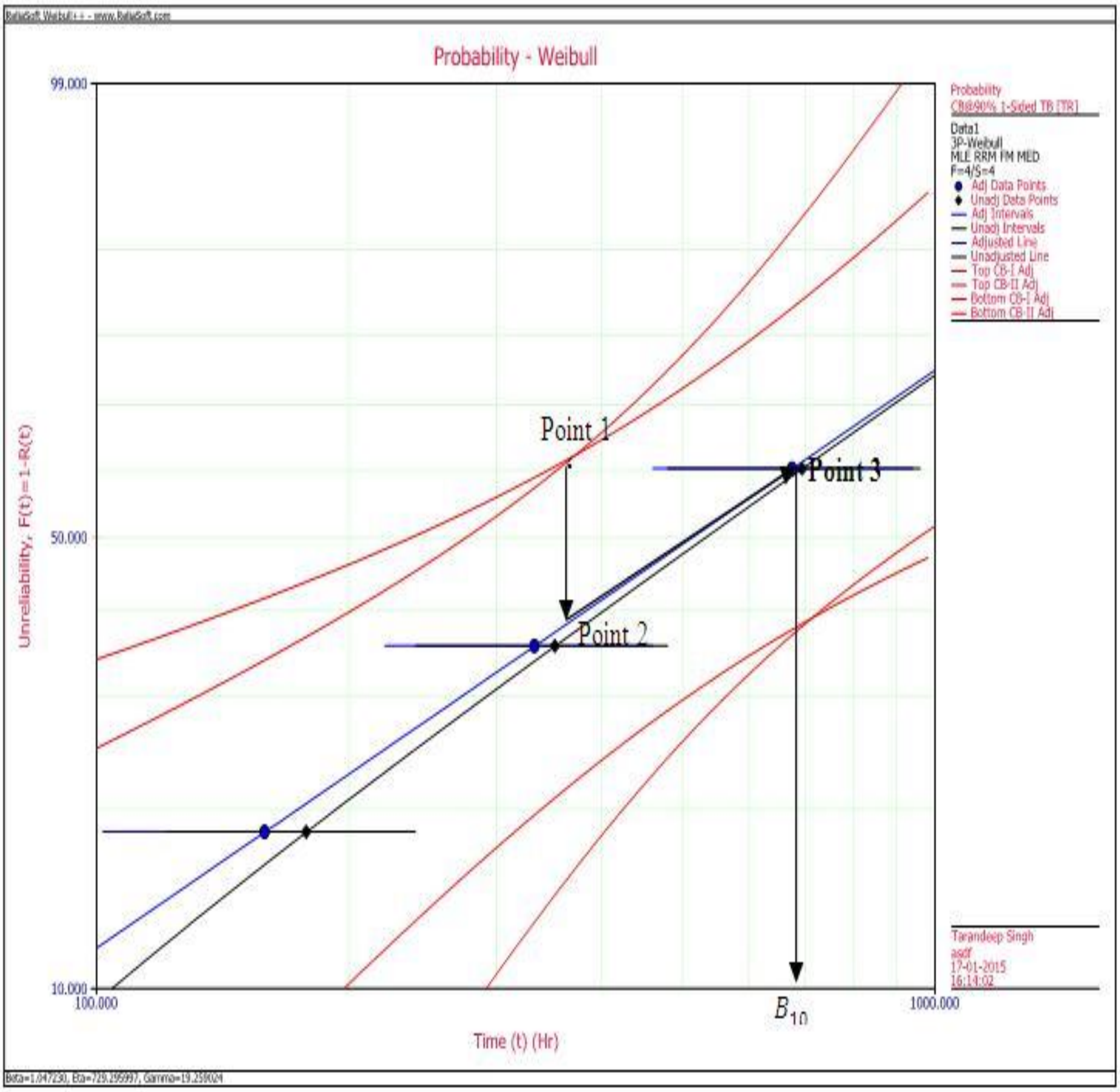

Figure 1 - Reliability vs. Time.

5. Determining minimum reliability without failures

On examining the model in the Weibull plot the following representation is obtained ($P_A = 0.85 >$ upper confidence bound 90% t= 1000$R_{min} = 90\%$) as shown in Table 1.

Minimum reliability for several tests with different running times used in the test as shown in Table 2, the running times are sorted in ascending order and the calculation started at the Subset ID 1 in the Table 2.

5.1. Determining BX% Life (B_{1o}) from minimum reliability

For determining a minimum reliability $R_{min}$from existing tests on our model Point (1) in the Figure 1. The mean service life ratioL_{vm}, equivalent to the previous tests. The following formula is used [7,8].

$$R_{min} = (1 - P_A)^{\sum_{i=1}^{k} Lv_i^h n_i^{-1}} = \\ =(1 - (1 - P_A)^{(Lvm^b n)^{-1}} \quad (8)$$

Rearranging the right side for L_v results in :

$$L_{vm} = \left(\frac{1}{n}\left(\frac{\ln(1-\text{PA})}{\ln(\text{R}_{\min})}\right)\right)^{1/\text{b}} \quad (9)$$

The reliability value on the Weibull curve with $P_A = 50\%$, the Point (2) in the Figure 1, compute as

$$R_{PA=50\%} = (1 - 0{,}5)^{1/(L_{vm}^b n)} \quad (10)$$

Now the Weibull curve is defined by specifying the slope b and the Point (2) on the curve shown in Figure 1. After Rearranging the Weibull distribution for T results in

$$T = \frac{t}{(-\ln(l-H))^{1/b}} = \frac{t_{gefordert}}{(-\ln(R_{PA=50\%}))^{1/b}} \quad (11)$$

B_{10} Point (3) shown in Figure 1 calculated as

$$B_{10} = T\left(\ln\left(\frac{1}{1-0{,}1}\right)\right)^{1/b} \quad (12)$$

6. Mean Life MTTF

Time is a common measure of life, Data points for life are also called "times-to-failure" and product life can be described in terms of time all the way through. The different types of life data provides different information about the life of the product, the analysis method can differ depending on the data type. Average time, the units in the collected data are expected to operate before failure. It is often referred to as mean time to failure (MTTF) or mean time between failures (MTBF) [2]. As it is made known in Table 1, that we have estimate MTTF =735.254298, on the "model for reducing weight and load on production server database" [5]. The data input in 3P-Weibull standard folio for working out of Mean life [4, 8] with Weibull++ software made known in Table 2.

The equation below is given for the 3P-Weibull distribution.

$$f(t) = \frac{\beta}{n}\left(\frac{\text{t}-\gamma}{\text{n}}\right)^{\beta-1} e^{-\left(\frac{\text{t}-\gamma}{\text{n}}\right)^{\beta}} \quad (13)$$

η defines where the bulk of the distribution lies.
β defines the shape of the distribution
γ defines the location of the distribution in time.
t defines failure time.

During the analysis through Weibull++ software we have calculated the value Beta=1.04722986475124, Eta=729.295997246573 and Gamma=19.2590244987316

7. Failure Rate

Failure rate is the calculation with which an engineered system, expressed in failures per hour. It is denoted by the letter λ (lambda). It is closely related Mean Time between Failures (MTBF), more commonly expressed for high quality systems. Failure rate is generally time dependent, and the rate changes over time with the expected life cycle of a system [2]. The factors account for safety and maintenance practices in engineering and industry practices. A similar failure ratio used in the transport industries, such as railways and trucking is 'Mean Distance between Failure', which attempts to associate actual, loaded distances to like reliability needs and practices. Failure rates are vital factors in insurance, business, and guideline practices as well as essential to design of safe systems during a nationwide or global economy [7,8]. We have calculated Failure Rate = 0.001294 on "Model for reducing weight and load on production server database" [5], with Weibull++ software [4], as shown in Table 1.

8. Prob. of Failure

If the Weibull shape factor is greater than one the analysis is indicating that rising hazard conditions apply. The probability of failure is therefore rising with time; the higher the β value, the greater is the rate of increase. This is often called the 'wear-out' phase, although again this term can be ambiguous. The time reliance of failures now permits levelheaded consideration of planned replacement providing the total cost of a failure replacement is greater than the total cost of a planned replacement. The interval for such replacements should be optimized and there is at least one general technique which will do this directly from the Weibull parameters [7].

The outcome of the Probability of failure Q(t=100) = 0.094964 on “Model for reducing weight and load on production server database” [5], shown in Table 1.

9. Conclusion and future work

In this paper we discussed the reliability estimation of “model for reducing weight and load on production server database” [5] based on 3-P Weibull distribution method. We have calculated Failure Rate, Probability of Failure, minimum reliability without any failures, BX% Life and mean time to failure (MTTF) on the data which have been recorded during the hypothesis working of the model. 3P-Weibull with analysis setting MLE (Maximum Likelihood), LRB (likelihood ratio) and K-M (Kaplan – Meier). The Weibull++ simulator is used for the reliability estimation. Further work can be done in this area using other methods such as 2P-Exponential, 1P-Exponential, G-Gama.

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