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Behaviour Analysis of Alloy Wheel Plant

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***Abstract:** In this paper, Behaviour Analysis of an Alloy Wheel Plant utilizing RPGT under specific conditions has been discussed. An Alloy Wheel Plant is isolated into five sub- systems P, Q, R, S and T for instances of computations. An Alloy Wheel Plant consists of five frame woks for example Gravity Die Machine (P), Cutting Machine (Q), Solutiuonizing Chamber Machine (R), Azing Chamber Machine(S) and Shot Blasting Machine (T). These subsystems are associated in arrangement. On the off chance that any of the sub units comes up short, at that point the Alloy Wheel plant works in diminished state. In the event that at least two sub units fall flat, at that point systems comes up short. Parametric estimations of a system generally rely upon failure / repair rate of individual units. Single server fixes all sub-units. Framework parameters, for example, Availability, MTSF and Number of Server's Visits utilizing RPGT are determined. Specific cases and behaviour analysis w.r.t different rates are additionally completed pursue by graphs.*

***Keywords:** Availability, busy- period of repairman, Behaviour Analysis*

1. INTRODUCTION

Presently a day, makers need to create their items un interruptedly to satisfy the regularly expanding needs of the their items. They can do so as such by making their creation units as effective as could be allowed. This paper talks about behavior analysis of an alloy wheel plant separated into five sub framework. MTSF, busy period of server, Availability, Number of visits are determined to utilize RPGT. A benefit capacity is additionally characterized for analyzing the benefit of system. Kumar et. al. (2019) the goal behind this specific paper is, as a rule, to decide the criticality of various sub systems through the conducted research of a multi-state repairable strategy with warm repetition. The availability of the gadget is streamlined to evaluate the most extreme blends of failure just as fix rate parameters for various sub-systems. Kumar A., Garg D et al. (2019) have discussed on sensitivity analysis of a cold standby system with Priority for Preventive Maintenance. Gulati et. al (2018) this paper handles the exploration of unwavering quality strides of a two units unwanted program under various kinds of failure just as two sorts of maintenance. Kumar A., Goel P., Garg D., Sahu A. (2017) have likewise talked about on behavior analysis in the urea fertilizer industry. Manglik and Mangey (2016) the objective of the investigation paper is, to demonstrate the reliability strides of a unit by speaking to a modern program having three subsystems.

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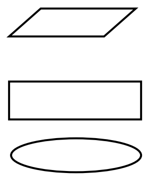
Two of the subsystems have reserve gadget despite the fact that the third one has n gadgets in parallel arrangement. The entire system can fall flat as a result of a failure in subsystems and because of the cataclysmic calamity.A.K Barak, S.K Chhillar (2013) distributed an exploration paper where they portrayed the assessment related with a parallel system with priority to fix over maintenance under subjective stuns.M. Ram, S. B. Singh et. al (2013) and A. Mehrtash et. al (2012) have Likewise talked about on reliability. Liu et al. (2011) analyzed the availability direct connected with a repairable procedure where reserve exchanged over to main is put through breakdown. The creators accepted the fix time span of administration station pursues four run of the mill distributions: blend, exponential, uniform and Gamma. Wu, C.H. and Zhang, Z.G. (2010) examined a progression of repairable framework which involves two non-unclear portions with one repairer, for finding the unfaltering quality attributes for the proportionate. Exhibited a paper where an enthalpy enumerating is associated with the solidifying technique of an emotional shape throwing in a structure tossing system. Sharma, R. and Sharma, G.C. (2015) in the rapidly creating development, faithful quality expects a basic activity in each and every industry from creation to the action of various systems. Thusly, it is a huge endeavor for the administration of the framework to keep up the steadfast quality and nature of their things.S.C. And Preeti (2010) Built up the steadfastness estimation of an arrangement system in which the section reliabilities are dark is considered. The perfect testing plan depends upon parameters that are normally dark. A back to back plan is presented and differentiated and both balanced designation and ideal allocation. Numerical assessments for a two-section arrangement system are given. The results demonstrate that the proposed consecutive inspecting plan is extraordinarily improved than balanced distribution and is practically perfect. Nourelfath et al. (2010) dissected a multi-state strategy with arranged assembling planning just as preventive upkeep. The creators in like manner proposed a procedure to evaluate the cost and furthermore the hours of preventive upkeep, little repair as well as common place assembling limit. Kumar et al. (2009) registered fluffy reliability just as fuzzy accessibility of the sequential practice in butter oil preparing plant under various kinds of repair and problems of sub system. Reliability assessment of industrial frameworks assumes a significant role for the clients and management, to enhance Frame work parameters standby units are utilized, repairable standby frameworks are significant for the notoriety of the industry. A repairman assumes a significant job to advance the framework parameters straightforwardly/ indirectly. In the event the administrations have pre-hand data that a particular unit needs more care in care in contrast with different units then the administrations can accomplish a great deal in their objectives.

This paper manages conduct investigations of a system having five units particular P, Q, R, S, T organized in an arrangement. System bombs totally when both of the units P, Q, R, S, or T comes up short. Taking consistent and factually autonomous failure and repair rate for every one of the units, system transition state diagram explaining all conceivable states, directed way transition along with disappointment and repair rates in transiting from one state to other utilizing Markov process and is displayed utilizing RPGT for behaviour analysis of framework parameters. Behaviour analysis and conclusion are drawn by planning tables and charts for various estimations of repair and disappointment paces of the units.

II. ASSUMPTIONS AND NOTATIONS

1. Single repair facility is accessible.
2. Failures and repairs are measurably free.
3. Repair is impeccable for example it doesn't harm any sub units during fix.
4. Whenever at least subunits flop at that point sub-system is in bombed state.
5. System is talked about for consistent state conditions.



α_i/ β_i $(1 \le i \ge 6)$: Constant failure/repair rates of units A/ of unit B.

$\bar{P}$: Reduced state.

P, Q, R, S, T / p, q, r, s, t: Operative state / failed state.

Following the above assumption & notations the Transition Diagram of the system is given in Fig. 1

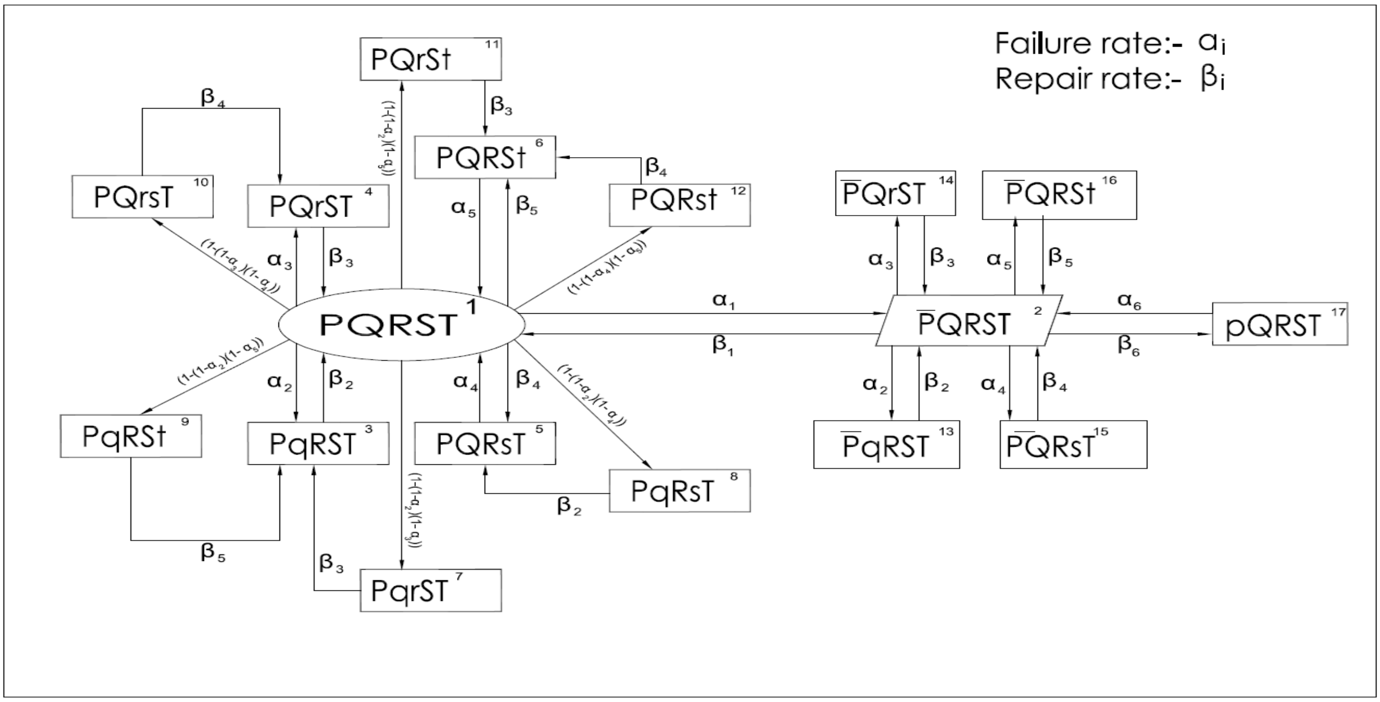


Fig.1. Transition Diagram of the System Design

III.MODEL DESCRIPTION

Here, a system which has five subsystems configured namely P, Q, R, S and T in series is modelled & analyzed for system parameters. Subsystems P, Q, R, and S have components in series, so if any of the components fails leads that unit to failed state causing whole system to failed state. Failure of any one of these subsystems causes the complete failure of system. Subsystem T consists of two units. One unit of subsystem T is active and other unit are in cold standby mode. It is assumed that system is repairable in both cases. Repairs are perfect and absolute, so after the repair every subsystem works as good as new. The failure & repair rates for units have been taken constant for steady state to represent the system transition state diagram.

Table.I Various Paths from vertices

Vertex I	J =1	J =2	J =3	J=4	J= 5	J=6	J=7	J=8	J=9
J = 1	(1,2,1)(1,3,1)(1,4,1) (1,5,1)(1,6,1) (1,7,3,1)(1,9,3,1) (1,8,5,1)(1,10,4,1) (1,11,6,1)(1,12,6,1)	(1,2)	(1,3)	(1,4)	(1,5)	(1,6)	(1,7)	(1,8)	(1,9)
J = 2	(2,1)	(2,1,2)(2,13,2) (2,14,2)(2,15,2) (2,16,2)(2,17,2)	(2,1,3)	(2,1,4)	(2,1,5)	(2,1,6)	(2,1,7)	(2,1,8)	(2,1,9)
J = 3	(3,1)	(3,1,2)	(3,1,3)	(3,1,4)	(3,1,5)	(3,1,6)	(3,1,7)	(3,1,8)	(3,1,9)
J = 4	(4,1)	(4,1,2)	(4,1,3)	(4,1,4)	(4,1,5)	(4,1,6)	(4,1,7)	(4,1,8)	(4,1,9)
J = 5	(5,1)	(5,1,2)	(5,1,3)	(5,1,4)	(5,1,5)	(5,1,6)	(5,1,7)	(5,1,8)	(5,1,9)
J = 6	(6,1)	(6,1,2)	(6,1,3)	(6,1,4)	(6,1,5)	(6,1,6)	(6,1,7)	(6,1,8)	(6,1,9)
J = 7	(7,3,1)	(7,3,1,2)	(7,3)	(7,3,1,4)	(7,3,1,5)	(7,3,1,6)	(7,3,1,7)	(7,3,1,8)	(7,3,1,9)
J = 8	(8,5,1)	(8,5,1,2)	(8,5,1,3)	(8,5,1,4)	(8,5,1,5)	(8,5,1,6)	(8,5,1,6)	(8,5,1,7)	(8,5,1,8)
J = 9	(9,3,1)	(9,3,1,2)	(9,3)	(9,3,1,4)	(9,3,1,5)	(9,3,1,6)	(9,3,1,7)	(9,3,1,8)	(9,3,1,9)
J =10	(10,4,1)	(10,4,1,2)	(10,4,1,3)	(10,4)	(10,4,1,5)	(10,4,1,6)	(10,4,1,7)	(10,4,1,8)	(10,4,1,9)
J =11	(11,6,1)	(11,6,1,2)	(11,6,1,3)	(11,6,1,4)	(11,6,1,5)	(11,6)	(11,6,1,7)	(11,6,1,8)	(11,6,19)
J =12	(12,6,1)	(12,6,1,2)	(1-2,6,1,3)	(12,6,1,4)	(12,6,1,5)	(12,6)	(12,6,1,7)	(12,6,1,8)	(12,6,1,9)
J=13	(13,2,1)	(13,2)	(13,2,1,3)	(13,2,1,4)	(13,2,1,5)	(13,2,1,6)	(13,2,1,7)	(13,2,1,8)	(13,2,1,9)
J =14	(14,2,1)	(14,2)	(14,2,1,3)	(14,2,1,4)	(14,2,1,5)	(14,2,1,6)	(14,2,1,7)	(14,2,1,8)	(14,2,1,9)
J =15	(15,2,1)	(15,2)	(15,2,1,3)	(15,2,1,4)	(15,2,1,5)	(15,2,1,6)	(15,2,1,7)	(15,2,1,8)	(15,2,1,9)
J =16	(16,2,1)	(16,2)	(16,2,1,3)	(16,2,1,4)	(16,2,1,5)	(16,2,1,6)	(16,2,1,7)	(16,2,1,8)	(16,2,19)
J =17	(17,2,1)	(17,2)	(17,2,1,3)	(17,2,1,4)	(17,2,1,5)	(17,2,1,6)	(17,2,1,7)	(17,2,1,8)	(17,2,1,9)

Vertex I	J=9	J=10	J=11	J=12	J=13	J=14	J=15	J=16	J=17
J = 1	(1,9)	(1,10)	(1,11)	(1,12)	(1,2,13)	(1,2,14)	(1,2,15)	(1,2,16)	(1,2,17)
J = 2	(2,1,9)	(2,1,10)	(2,1,11)	(2,1,12)	(2,13)	(2,14)	(2,15)	(2,16)	(2,17)

J = 3	(3,1,9)	(3,1,10)	(3,1,11)	(3,1,12)	(3,1,2,13)	(3,1,2,14)	(3,1,2,15)	(3,1,2,16)	(3,1,2,17)
J = 4	(4,1,9)	(4,1,10)	(4,1,11)	(4,1,12)	(4,1,2,13)	(4,1,2,14)	(4,1,2,15)	(4,1,2,16)	(4,1,2,17)
J = 5	(5,1,9)	(5,1,10)	(5,1,11)	(5,1,12)	(5,1,2,13)	(5,1,2,14)	(5,1,2,15)	(5,1,2,16)	(5,1,2,17)
J = 6	(6,1,9)	(6,1,10)	(6,1,11)	(6,1,12)	(6,1,2,13)	(6,1,2,14)	(6,1,2,15)	(6,1,2,16)	(6,1,2,17)
J = 7	(7,3,1,9)	(7,3,1,10)	(7,3,1,11)	(7,3,1,12)	(7,3,1,2,13)	(7,3,1,2,14)	(7,3,1,2,15)	(7,3,1,2,16)	(7,3,1,2,17)
J = 8	(8,5,1,9)	(8,5,1,10)	(8,5,1,11)	(8,5,1,12)	(8,5,1,2,13)	(8,5,1,2,14)	(8,5,1,2,15)	(8,5,1,2,16)	(8,5,1,2,17)
J = 9	(9,3,1,9)	(9,3,1,10)	(9,3,1,11)	(9,3,1,12)	(9,3,1,2,13)	(9,3,1,2,14)	(9,3,1,2,15)	(9,3,1,2,16)	(9,3,1,2,17)
J =10	(10,4,1,9)	(10,4,1,10)	(10,4,1,11)	(10,4,1,12)	(10,4,1,2,13)	(10,4,1,2,14)	(10,4,1,2,15)	(10,4,1,2,16)	(10,4,1,2,17)
J =11	(11,6,1,9)	(11,6,1,10)	(11,6,1,11)	(11,6,1,12)	(11,6,1,2,13)	(11,6,1,2,14)	(11,6,1,2,15)	(11,6,1,2,16)	(11,6,1,2,17)
J =12	(12,6,1,9)	(12,6,1,10)	(12,6,1,11)	(12,6,1,12)	(12,6,1,2,13)	(12,6,1,2,14)	(12,6,1,2,15)	(12,6,1,2,16)	(12,6,1,2,17)
J=13	(13,2,1,9)	(13,2,1,10)	(13,2,1,11)	(13,2,1,12)	(13,2,13)	(13,2,14)	(13,2,15)	(13,2,16)	(13,2,17)
J =14	(14,2,1,9)	(14,2,1,10)	(14,2,1,11)	(14,2,1,12)	(14,2,13)	(14,2,14)	(14,2,15)	(14,2,16)	(14,2,17)
J =15	(15,2,1,9)	(15,2,1,10)	(15,2,1,11)	(15,2,1,12)	(15,2,13)	(15,2,14)	(15,2,15)	(15,2,16)	(15,2,17)
J =16	(16,2,1,9)	(16,2,1,10)	(16,2,1,11)	(16,2,1,12)	(16,2,13)	(16,2,14)	(13,2,15)	(16,2,16)	(16,2,17)
J =17	(17,2,1,9)	(17,2,1,10)	(17,2,1,11)	(17,2,1,12)	(17,2,13)	(17,2,14)	(17,2,15)	(17,2,16)	(17,2,17)

Table II. Primary, Secondary, Tertiary Circuits w. r. t. the Simple Paths (Initial-State ‘1’) To Vertex ‘1’

Vertex	S_R $1 \longrightarrow J$ (P_1)	P_2	P_3	$P_{4.}$	P_5

1	$1 \xrightarrow{S_1} J$ (1,2,1) $1 \xrightarrow{S_2} J$ (1,3,1) $1 \xrightarrow{S_3} J$ (1,4,1) $1 \xrightarrow{S_4} J$ (1,5,1) $1 \xrightarrow{S_5} J$ (1,6,1) $1 \xrightarrow{S_6} J$ (1,7,3,1) $1 \xrightarrow{S_7} J$ (1,8,5,1) $1 \xrightarrow{S_8} J$ (1,9,3,1) $1 \xrightarrow{S_9} J$ (1,10,4,1) $1 \xrightarrow{S_{10}} J$ (1,11,6,1) $1 \xrightarrow{S_{11}} J$ (1,12,6,1)	(2,14,2) (2,15,2)(2,16,2)(2,17,2) NIL NIL NIL NIL NIL NIL NIL NIL NIL NIL	NIL NIL NIL NIL NIL NIL NIL NIL NIL NIL NIL	NIL NIL NIL NIL NIL NIL NIL NIL NIL NIL NIL	NIL NIL NIL NIL NIL NIL NIL NIL NIL NIL NIL
2	$1 \xrightarrow{S_1} 2$ (1,2)	(2,14,2) (2,15,2)(2,16,2)(2,17,2)	NIL	NIL	NIL
3	$1 \xrightarrow{S_1} 3$ (1,3)	NIL	NIL	NIL	NIL
4	$1 \xrightarrow{S_1} 4$ (1,4)	NIL	NIL	NIL	NIL
5	$1 \xrightarrow{S_1} 5$ (1,5)	NIL	NIL	NIL	NIL
6	$1 \xrightarrow{S_1} 6$ (1,6)	NIL	NIL	NIL	NIL
7	$1 \xrightarrow{S_1} 7$ (1,7)	NIL	NIL	NIL	NIL
8	$1 \xrightarrow{S_1} 8$ (1,8)	NIL	NIL	NIL	NIL
9	$1 \xrightarrow{S_1} 9$ (1,9)	NIL	NIL	NIL	NIL
10	$1 \xrightarrow{S_1} 10$ (1,10)	NIL	NIL	NIL	NIL
11	$1 \xrightarrow{S_1} 11$ (1,11)	NIL	NIL	NIL	NIL

12	S_1 $1 \longrightarrow 12$ (1,2)	NIL	NIL	NIL	NIL
13	S_1 $1 \longrightarrow 13$ (1,2,13)	(2,14,2) (2,15,2)(2,16,2)(2,17,2)	NIL	NIL	NIL
14	S_1 $1 \longrightarrow 14$ (1,2,14)	(2,13,2) (2,15,2)(2,16,2)(2,17,2)	NIL	NIL	NIL
15	S_1 $1 \longrightarrow 15$ (1,2,15)	(2,14,2) (2,13,2)(2,16,2)(2,17,2)	NIL	NIL	NIL
16	S_1 $1 \longrightarrow 16$ (1,2,16)	(2,14,2) (2,15,2)(2,13,2)(2,17,2)	NIL	NIL	NIL
17	S_1 $1 \longrightarrow 17$ (1,2,17)	(2,14,2) (2,15,2)(2,16,2)(2,13,2)	NIL	NIL	NIL

Table III. Transition Probabilities

$q_{i,j}(t)$	$P_{i,j} = q_{i,j}^{*}(t)$
$Q_{1,2}(t) = \alpha_1 e^{-(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})(t)}$	$P_{1,2}(t)=\frac{\alpha_1}{(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})}$
$Q_{1,3}(t) = \alpha_2 e^{-(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})(t)}$	$P_{1,3}(t)=\frac{\alpha_2}{(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})}$
$Q_{1,4}(t) = \alpha_3 e^{-(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})(t)}$	$P_{1,4}(t)=\frac{\alpha_3}{(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})}$
$Q_{1,5}(t) = \alpha_4 e^{-(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})(t)}$	$P_{1,5}(t)=\frac{\alpha_4}{(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})}$
$Q_{1,6}(t) = \alpha_5 e^{-(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})(t)}$	$P_{1,6}(t)=\frac{\alpha_5}{(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})}$
$Q_{1,7}(t) = \alpha_7 e^{-(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})(t)}$	$P_{1,7}(t)=\frac{\alpha_7}{(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})}$
$Q_{1,8}(t) = \alpha_8 e^{-(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})(t)}$	$P_{1,8}(t)=\frac{\alpha_8}{(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})}$
$Q_{1,9}(t) = \alpha_9 e^{-(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})(t)}$	$P_{1,9}(t)=\frac{\alpha_9}{(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})}$
$Q_{1,10}(t) = \alpha_{10} e^{-(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})(t)}$	$P_{1,10}(t)=\frac{\alpha_{10}}{(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})}$
$Q_{1,11}(t) = \alpha_{11} e^{-(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})(t)}$	$P_{1,11}(t)=\frac{\alpha_{11}}{(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})}$
$Q_{1,12}(t) = \alpha_{12} e^{-(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})(t)}$	$P_{1,12}(t)=\frac{\alpha_{12}}{(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})}$
$Q_{2,1}(t) = \beta_1 e^{-(\beta_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6)(t)}$	$P_{2,1}(t)=\frac{\beta_1}{(\beta_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6)}$
$Q_{2,13}(t) = \alpha_2 e^{-(\beta_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6)(t)}$	$P_{2,13}(t)=\frac{\alpha_2}{(\beta_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6)}$
$Q_{2,14}(t) = \alpha_3 e^{-(\beta_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6)(t)}$	$P_{2,14}(t)=\frac{\alpha_3}{(\beta_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6)}$
$Q_{2,15}(t) = \alpha_4 e^{-(\beta_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6)(t)}$	$P_{2,15}(t)=\frac{\alpha_4}{(\beta_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6)}$
$Q_{2,16}(t) = \alpha_5 e^{-(\beta_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6)(t)}$	$P_{2,16}(t)=\frac{\alpha_5}{(\beta_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6)}$
$Q_{2,17}(t) = \alpha_6 e^{-(\beta_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6)(t)}$	$P_{2,17}(t)=\frac{\alpha_6}{(\beta_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6)}$
$Q_{3,1}(t) = \beta_2 e^{-(\beta_2)(t)}$	$P_{3,1}(t)=1\ (\frac{\beta_2}{\beta_2})$
$Q_{4,1}(t) = \beta_3 e^{-(\beta_3)(t)}$	$P_{4,1}(t)=1$
$Q_{5,1}(t) = \alpha_4 e^{-(\alpha_4)(t)}$	$P_{5,1}(t)=1$
$Q_{6,1}(t) = \alpha_5 e^{-(\alpha_5)(t)}$	$P_{6,1}(t)=1$
$Q_{7,1}(t) = \alpha_7 e^{-(\alpha_7)(t)}$	$P_{7,1}(t)=1$
$Q_{8,1}(t) = \alpha_8 e^{-(\alpha_8)(t)}$	$P_{8,1}(t)=1$
$Q_{9,1}(t) = \alpha_9 e^{-(\alpha_9)(t)}$	$P_{9,1}(t)=1$
$Q_{10,1}(t) = \alpha_{10} e^{-(\alpha_{10})(t)}$	$P_{10,1}(t)=1$
$Q_{11,1}(t) = \alpha_{11} e^{-(\alpha_{11})(t)}$	$P_{11,1}(t)=1$

$Q_{12,1}(t) = \alpha_{12} e^{-(\alpha_{12})(t)}$	$P_{12,1}(t)=1$
$Q_{13,2}(t) = \beta_{13}\, e^{-(\beta_2)(t)}$	$P_{13,2}(t)=1$
$Q_{14,2}(t) = \beta_{14}\, e^{-(\beta_3)(t)}$	$P_{14,2}(t)=1$
$Q_{15,2}(t) = \beta_{15}\, e^{-(\beta_4)(t)}$	$P_{15,2}(t)=1$
$Q_{16,2}(t) = \beta_{16}\, e^{-(\beta_5)(t)}$	$P_{16,2}(t)=1$
$Q_{17,2}(t) = \beta_{17} e^{-(\beta_6)(t)}$	$P_{17,2}(t)=1$

Table IV. Mean Sojourn Times

$R_i(t)$	$\mu_i R_i^*(0)$
$R_1(t)= e^{-(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})(t)}$	$\mu_1 = \frac{1}{(\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6+\cdots+\alpha_{12})}$
$R_2(t)=e^{-(\beta_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6)(t)}$	$\mu_2 = \frac{1}{\beta_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5+\alpha_6)}$
$R_3(t)=e^{-\beta_2(t)}$	$\mu_3 = \frac{1}{\beta_2}$
$R_4(t)=e^{-\beta_3(t)}$	$\mu_4 = \frac{1}{\beta_3}$
$R_5(t)=e^{-\alpha_4(t)}$	$\mu_5 = \frac{1}{\alpha_4}$
$R_6(t)=e^{-\alpha_5(t)}$	$\mu_6 = \frac{1}{\alpha_5}$
$R_7(t)=e^{-\alpha_7(t)}$	$\mu_7 = \frac{1}{\alpha_7}$
$R_8(t)=e^{-\alpha_8(t)}$	$\mu_8 = \frac{1}{\alpha_8}$
$R_9(t)=e^{-\alpha_9(t)}$	$\mu_9 = \frac{1}{\alpha_9}$
$R_{10}(t)=e^{-\alpha_{10}(t)}$	$\mu_{10} = \frac{1}{\alpha_{10}}$
$R_{11}(t)=e^{-\alpha_{11}(t)}$	$\mu_{11} = \frac{1}{\alpha_{11}}$
$R_{12}(t)=e^{-\alpha_{12}(t)}$	$\mu_{12} = \frac{1}{\alpha_{12}}$
$R_{13}(t)=e^{-\beta_2(t)}$	$\mu_{13} = \frac{1}{\beta_2}$
$R_{14}(t)=e^{-\beta_3(t)}$	$\mu_{14} = \frac{1}{\beta_3}$
$R_{15}(t)=e^{-\beta_4(t)}$	$\mu_{15} = \frac{1}{\beta_4}$
$R_{16}(t)=e^{-\beta_5(t)}$	$\mu_{16} = \frac{1}{\beta_5}$
$R_{17}(t)=e^{-\beta_6(t)}$	$\mu_{17} = \frac{1}{\beta_6}$

V. ASSESSMENT OF PARAMETER

The frame work as under the transition likelihood variable of all the reachable states from the base state '1' is:$V_{1,1} = 1$ (Verified)$V_{1,2} = \frac{(1,2)}{(1-(2,13,2))(1-(2,14,2))(1-(2,15,2))(1-(2,16,2))(1-(2,17,2))}$ and So on.**MTSF (T_0)**: From figure 1, the regenerative UN – failed stateto Which framework can travel (beginning state '1'), proceedings entering any failed state are i = 1,2,13,14,15,16 taking 'ε' =0

MTSF (T_0) =

$$\left[\sum_{i,s_r}\left\{\frac{\left\{pr\left(\xi \xrightarrow{s_r(sff)} i\right)\right\}.\mu_i}{\prod_{m_1\neq\xi}\{1-V_{\overline{m_1,m_1}}\}}\right\}\right] \div \left[1-\sum_{s_r}\left\{\frac{\left\{pr\left(\xi \xrightarrow{s_r(sff)} \xi\right)\right\}}{\prod_{m_2\neq\xi}\{1-V_{\overline{m_2,m_2}}\}}\right\}\right]$$

$$T_0 = \frac{V_{1,1}\mu_1 + V_{1,2}\mu_2 + V_{1,13}\mu_{13} + V_{1,14}\mu_{14} + V_{1,15}\mu_{15} + V_{1,16}\mu_{16}}{1-P_{12}.P_{21}}$$

AVAILABILITY OF THE SYSTEM (A_0): From figure 1 the regenerative states at which the framework is accessible are j = (1, 2, 1 3, 14, 15, 16) and i = 1, 2… 17 taking 'ε' =0.

$A_0 =$

$$\left[\sum_{j,s_r}\left\{\frac{\left\{pr\left(\xi \xrightarrow{s_r} j\right)\right\} f_j.\mu_j}{\prod_{m_1\neq\xi}\{1-V_{m_1,m_1}\}}\right\}\right] \div \left[\sum_{i,s_r}\left\{\frac{\left\{pr\left(\xi \xrightarrow{s_r} i\right)\right\}.\mu_i^1}{\prod_{m_2\neq\xi}\{1-V_{m_2,m_2}\}}\right\}\right]$$

$$A_0 = \left[\sum_j V_{\xi,j}\ .f_j.\mu_j\right] \div \left[\sum_i V_{\xi,i}\ .\mu_i^1\right]$$

$$A_0 = \frac{V_{1,1}\mu_1 + V_{1,2}\mu_2 + V_{1,13}\mu_{13} + V_{1,14}\mu_{14} + V_{1,15}\mu_{15} + V_{1,16}\mu_{16}}{V_{1,1}\mu_1 + V_{1,2}\mu_2 + V_{1,1}\mu_3 + \ldots\ldots\ldots\ldots + V_{1,17}\mu_{17}}$$

$$A_0 = \frac{V_{1,1}\mu_1 + V_{1,2}\mu_2 + V_{1,13}\mu_{13} + V_{1,14}\mu_{14} + V_{1,15}\mu_{15} + V_{1,16}\mu_{16}}{D}$$

WhereD= $V_{1,1}\mu_1 + V_{1,2}\mu_2 + V_{1,1}\mu_3 + \ldots\ldots\ldots\ldots\ldots + V_{1,17}\mu_{17}$

BUSY PERIOD (B_0): From figure 1 the regenerative states where server is occupied while doing fixes are j = 2, 3 ... 17 and the regenerative the regenerative state are i= 1, 2…….. 17, ‘ξ’ =0.

$B_0 =$

$$\left[\sum_{j,s_r}\left\{\frac{\{pr(\xi \xrightarrow{S_r} j)\}.\eta_j}{\prod_{m_1\neq\xi}\{1-V_{m_1,m_1}\}}\right\}\right] \div \left[\sum_{i,s_r}\left\{\frac{\{pr(\xi \xrightarrow{S_r} i)\}.\mu_i^1}{\prod_{m_2\neq\xi}\{1-V_{m_2,m_2}\}}\right\}\right]$$

$$B_0 = \left[\sum_j V_{\xi,j}\,.\eta_j\right] \div \left[\sum_i V_{\xi,i}\,.\mu_i^1\right]$$

$$B_0 = \frac{V_{1,2}\mu_1 + V_{1,3}\mu_3 + \cdots + V_{1,14}\mu_{14} + V_{1,15}\mu_{15} + V_{1,16}\mu_{16} + V_{1,17}\mu_{17}}{D}$$

EXPECTED NUMBER OF REPAIREMAN (V_0): From the figure 1 the regenerative states where server visit for fix of the framework are ‘j’ = 1 and the regenerative states are ‘i’ = 1 to 17, ‘ξ’ = 0, the expected number of server visit per unit time is given by

$$V \quad \left[\sum_{j,sr}\left\{\frac{\{pr(\xi \xrightarrow{Sr} j)\}}{\pi_{m_1\neq\xi}(1-V_{m_{1,m1}})}\right\}\right] \div \left[\sum_{i,sr}\left\{\frac{\{pr(\xi \xrightarrow{Sr} j)\}\mu_i'}{\pi_{m_2\neq\xi}(1-V_{m_{2,m2}})}\right\}\right]$$

$V_0 =$

$$\frac{V_{1,3} + V_{1,4} \dots\dots\dots\dots\dots + V_{1,17}}{D}$$

PARTICULAR CASES: $\beta_i = \beta$(i= 1, 2, 3, 4, 5, 6)

$\alpha_i = \alpha$ (i=1,2,3,4,5,6,7,8,9,10,11,12

Table VI. Mean Times to System Failures

Table VI. Mean Times to System Failures

	β = 0.50	β = 0.55	β = 0.60	β = 0.65
α = 0.10	1.32790	1.29882	1.23030	1.20120
α = 0.15	1.12325	1.06139	1.01455	1.01123
α = 0.20	0.93581	0.81081	0.72492	0.71232
α = 0.25	0.83251	0.71235	0.63251	0.61251

Table VIII. Busy Period of Server

	β = 0.50	β = 0.55	β = 0.60	β = 0.65
α = 0.10	0.11455	0.11461	0.11477	0.11488
α = 0.15	0.24813	0.24865	0.24897	0.24901
α = 0.20	0.31482	0.32267	0.32813	0.33231
α = 0.25	0.42561	0.42863	0.43125	0.43654

Table VII. Availability of the system

	β = 0.50	β = 0.55	β = 0.60	β = 0.65
α = 0.10	0.11904	0.11419	0.11517	0.10914
α = 0.15	0.12328	0.12204	0.12006	0.11904
α = 0.20	0.14288	0.13235	0.12499	0.11356
α = 0.25	0.16298	0.15236	0.14256	0.13265

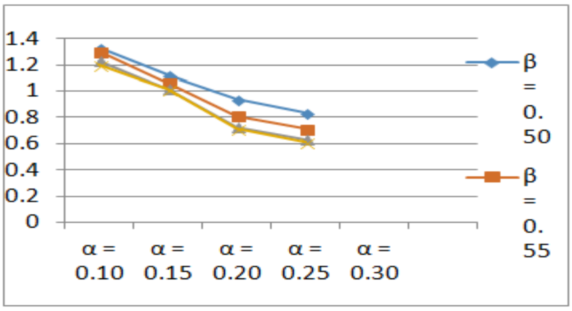


Fig. 2. Mean Times to System Failures

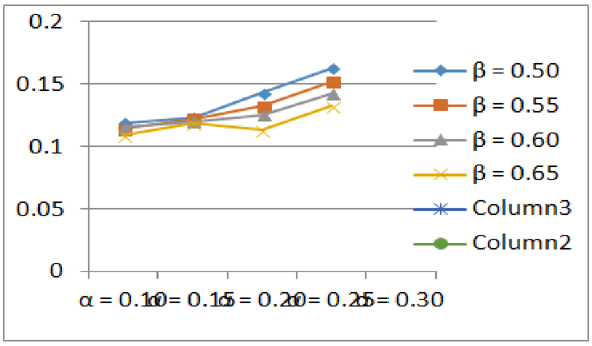


Fig.3. Availability of the system

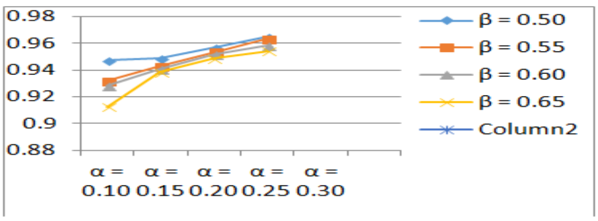


Fig.4. Busy period of Server by the repairman

A gander at the table 5 and graph 2 it is obtained that MTSF is large for lower estimations of failure rates of various units subsequently to have longer MTSF failure rates of the considerable number of units ought to be most reduced one for example every one of units must be of good quality and design. A system is ideal if the estimation of A0 is most elevated for given values failure and repair rates of units. From the above table 6 estimation of A0 is best corresponding to the most reduced repair rate β. From the last column it is likewise of the considerable number of units ought to be most reduced one for example every one of units must be of good quality and design. A system is ideal if the estimation of A0 is most elevated for given values failure and repair rates of units. From the above table 6 estimation of A0 is best corresponding to the most reduced repair rate β. From the last column it is likewise that there is no significant increment in estimation of A0 in contrasted with the increase in the repair rates of different units. A framework is said to be ideal if the server‘s busy period is smallest. From the above table 7 and graph 4 it is seen that busy period values are least if unit‘s disappointment rate are little as seen from the third Column of the above table. On expending failure rate of units it is watched relating to the expansion in disappointment place of unit 'P'the estimation of B0 expands all more quickly contrasted with the failure rate of another unit. From the above table 8, it is seen that the estimation of T0 expands all the more quickly with the expansion in failure rate.

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