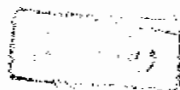




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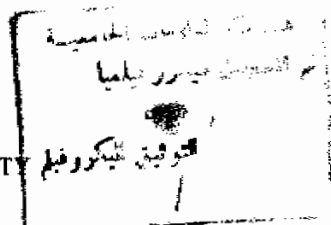


كتاب
مكتبة

PROBABILISTIC ANALYSIS OF SOME MODELS OF REDUNDANT SYSTEMS UNDER FAILURE AND REPAIR

THESIS

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AIN SHAMS UNIVERSITY



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ARABIC SUMMARY.

the 1990s, the incidence of *S. flexneri* has increased in the United Kingdom [10]. In the United States, *S. flexneri* has been reported as the most common serotype in children with acute bacterial dysentery [11].

There is a paucity of data on the epidemiology of *S. flexneri* in the United Kingdom. In the 1970s, *S. flexneri* was reported as the most common serotype in children with acute bacterial dysentery in the United Kingdom [12]. In the 1980s, *S. flexneri* was reported as the most common serotype in children with acute bacterial dysentery in the United Kingdom [13]. In the 1990s, *S. flexneri* was reported as the most common serotype in children with acute bacterial dysentery in the United Kingdom [14].

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PREFACE

the 1990s, the number of people in the UK who are employed in the public sector has increased by 1.5 million, from 2.5 million in 1980 to 4 million in 1995. The public sector has become a major employer in the UK, and its growth has been a major factor in the overall growth of the economy.

The public sector has also become a major provider of social services, and its growth has been a major factor in the overall growth of the economy. The public sector has become a major provider of social services, and its growth has been a major factor in the overall growth of the economy. The public sector has become a major provider of social services, and its growth has been a major factor in the overall growth of the economy.

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PREFACE

The thesis deals with analytical methods with graphical representation for studying some problems in reliability theory from many points of view. It consists of four chapters and one appendix for computer programs developed in this thesis.

The first chapter considers two systems each having a single unit which can operate in different conditions. The first system consists of a single unit which can operate in normal or abnormal condition (e.g. normal and stormy weather) while the second consists of a single unit operated by a person who may be in good or poor physical condition which also affects the performance of the system. The failure and repair times of the unit, change times of different conditions and change times of physical conditions of the operator are assumed to have different arbitrary distributions. Explicit expressions for the mean time to system failure and the availability analysis are obtained in each system with graphical representation, pertaining to the case when all distributions are exponential. The results in [18] have been derived as special case from the results of this chapter.

The second chapter deals with the probabilistic behaviour of a system consisting of two-unit (priority and ordinary) warm standby subject to degradation. Initially the priority unit is operative and the ordinary unit is kept as a warm standby. The priority unit passes through three different operative stages (excellent, good and satisfactory) before it fails. The unit (priority or ordinary) goes for repair at the instant the unit fails. A single service facility is available for repairing a failed unit. The priority unit enters into the total failure mode only from the satisfactory stage, and after repair it enters into the normal mode with any of the "excellent", "good" and "satisfactory" stages with different probabilities. The random variables concerning failure, repair and degradation times are assumed to be arbitrarily general distributions. The mean time to system failure (MTSF) and the mean time to system recovery (MTSR) for this system have been

obtained. Three special cases were studied, the first case concerned when the standby is cold, in the second case when standby is cold and the degradation time distributions of priority unit and failure time distributions of both the units are taken Rayleigh with different parameters while all the repair time distributions are negative exponential, while in the third case when the standby is warm and the degradation time distributions of priority-unit and failure time distributions of both the units are taken Rayleigh with different parameters. The results given in [27] have been derived as special case from the results of this chapter. A computer program to calculate the MTSF and MTSR of the system is developed for the third special case (see Appendix A1).

The third chapter discusses the cost-benefit analysis of a computer system with two non-identical intelligent terminals arranged in parallel and a central processing unit (CPU). There are two types of failure for each terminal - hardware failure and software failure. When failure the terminals are inspected, to determine the type of failure. After inspection the server repairs the failed terminal. If, during the repair of terminal, the other terminal fails, then this terminal waits for inspection and repair. The CPU may fail for some common cause. The random variables concerning failure, repair and inspection times are different and generally distributed functions. The mean time to system failure (MTSF), steady state availability of the system, expected busy period of the repairman, expected number of visits by the repairman and expected profit earned by the system are calculated. Two special cases were studied, the first case concerned with similar terminals and in the second case the two terminals are dissimilar with failure, repair and inspection time having exponential distributions. The results given in [19] have been derived as special case from the results of this chapter. A computer program to calculate the MTSF for the second case is also given (see Appendix A2).

The fourth chapter considers the cost analysis of three units standby system with preventive maintenance, random shocks are linearly increasing failure rates. Initially one

unit is operative and the other two are kept as cold standby. The operating unit is subject to random shocks occurring from time to time. Due to shock it may happen with a fixed known probability that (i) the operating unit is not all affected, (ii) the failure rate of the unit increases and the unit is said to work in a quasi-normal mode, (iii) the operating unit fails totally. The operating unit in quasi-normal mode either remains unaffected or fails totally. The operating unit is subject to preventive maintenance is provided to this system at random epochs, with no failure. A single repairman is available in the system who immediately starts the repair of a unit that has failed, either due to shocks or due to operation. The repaired unit works as if new. The random variables concerning failure, repair, shock and maintenance times have general distribution. The mean time to system failure (MTSF), steady state availability, probability that the repairman is busy, expected number of visits by the repairman and the profit earned by the system are obtained. Three special cases were studied. The first case concerned with the system without preventive maintenance, in the second case with the system without preventive maintenance, failure time distributions of the operative unit are taken to be Rayleigh with different parameters while the repair and shock time distributions are negative exponentials, while in the third case the system with preventive maintenance, failure time distributions of the operative unit are taken to be Rayleigh with different parameters while the repair and shock time distributions are negative exponentials. The results given in [29] have been derived as special case from the results of this chapter. Computer programs to calculate the MTSF of the two cases are developed from the second and third special cases (see Appendices A31 and A32).

Appendix consists of computer programs with a graphical representations to compute the mean time to system failure for different systems allover the thesis.

