

Name of the student

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Exercise n. 1

Evaluate the reliability and the steady state availability of a system composed of nine CPU (working in parallel and whose output is given by a voter), a RAID 5 system with five disks, two system buses (working in parallel and whose outputs are given by voters), one keyboard, one printer and one monitor, with the hypothesis that the faults happen according to an exponential distribution with rate equal to  $\lambda_{CPU}$ ,  $\lambda_{DISK}$ ,  $\lambda_{BUS}$ ,  $\lambda_{VOT}$ ,  $\lambda_{KEY}$ ,  $\lambda_{PRI}$ ,  $\lambda_{MON}$ . A single repair technician for component type is available and can repair at most two components per time in case of CPU, BUS and DISK faults with repair rate equal to  $\mu_{CPU}$ ,  $\mu_{DISK}$ ,  $\mu_{BUS}$ , instead in case of VOTER, printer, keyboard and monitor the repair rate ( $\mu_{VOT}$ ,  $\mu_{PRI}$ ,  $\mu_{KEY}$ ,  $\mu_{MON}$ ) is independent by the number of fault occurrences of the same type.

N.B. Advice: evaluate each global index analyzing by single sub system.

Exercise n. 2

Evaluate the service time to transmit a TCP segment (130.000 bytes) over an Ethernet LAN given that: 18 byte (overhead) are for the frame Ethernet header, 1.500 bytes (max data area) and 100 Mbyte/sec (bandwidth).

N.B Advice: draw the frames showing the number of bytes for each field

Exercise n. 3

Evaluate the average response time and throughput for a system composed of three servers with a finite queue (at most 5 users in the system), with a finite number of users (number of users equal 6), given that the think time for each user is 8 sec and the service time is 1 sec.

Exercise n.4

A Web site receives 10 requests per second. These requests are served by a cluster of 2 identical servers. A workload balancer divides in equal parts the load among the servers. Every request needs 20 ms of CPU and 5 I/O requests to a disk, the time for each I/O is 5 ms. Every server can manage at most 3 users at the same time and has a MTTF equal to 4.000 hours and a MTTR equal to 4

0 hours.

Calculate the average service time, the average throughput and the percentage of requests refused.