

# CAPACITY PLANNING

## 13 JANUARY 2012

**Name of the student**

### **Exercise n. 1**

Evaluate the reliability, the steady state availability and the safety of a system composed of three CPU (working in parallel and whose output is given by a voter), one RAID 3 system with four disks, two bus system (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  $\lambda_{CPU}$ ,  $\lambda_{DISK}$ ,  $\lambda_{BUS}$ ,  $\lambda_{KEY}$ ,  $\lambda_{MON}$ ,  $\lambda_{PRI}$ ,  $\lambda_{VOTER-CPU}$ ,  $\lambda_{VOTER-BUS}$ , with covering factors equal to  $C_{CPU}$ ,  $C_{DISK}$ ,  $C_{BUS}$ ,  $C_{KEY}$ ,  $C_{MON}$ ,  $C_{PRI}$  (the covering factor for the voters is equal to one) and with the same repair rate ( $\mu$ ) for all kind of components. A single "repair technician for component type" is available and the repair rate is independently 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 (20.000 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 a single server with a finite queue (at most 4 users in the system), with a finite number of users (number of users equal 6), given that the think time for each user is 30 sec and the service rate is 20 sec.

### **Exercise**

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 10 ms of CPU and 2 I/O requests to a disk, the time for each I/O is 10 ms. Every server can manage at most 4 users at the same time and has a MTTF equal to 10.000 hours and a MTTR equal to 10 hours.

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

N.B Advice: A time shown the methodology you have to evaluate at least the average service time, the average throughput and the percentage of requests refused when all the servers are fault-free.