

COMP5348 Assignment 2 (Semester 1 2009)

Due: Submit by WebCT by 9pm on Thursday April 30

Done in groups of 3 (or 4 if necessary); no pair to be together in both asst1 and asst2!

Remember to hand in a cover sheet for "Groupwork Declaration of Academic Honesty"

Some of these questions are adapted from material of Prof Harchol-Balter (CMU).

Q1 (2 marks) Consider an open network consisting of two devices. Packets arrive at device 1 from the outside with a rate of r_1 jobs/sec, and other packets arrive at device 2 at a rate of 10 jobs/sec. Whenever a packet has been processed by device 1, it will leave the system with probability 0.7, and otherwise (probability 0.3) it moves to device 2. When a packet has been serviced at device 2, it leaves the system with probability 0.5 and moves to device 1 otherwise. The mean service time for a visit at device 1 is 0.1s, and the mean service time for a visit at device 2 is 0.05s. Calculate the rate r_1 at which some device becomes saturated; for this value of r_1 , what are the utilizations for each device?

Q2 (6 marks) We observe a closed system for 30 minutes, during which 1600 tasks are completed, from 12 terminals. Each terminal (source of tasks) has a think time of 12s between receiving the response to one task, and submitting the next task. The system has a CPU and two disks, one is fast, the other is slow. The fast disk can deliver a block in 1/2 of the time that the slow disk would take. During the observation period, 32000 accesses occur at the fast disk, and 12000 accesses at the slow disk. During the observation period, the CPU is busy for 1080s, the fast disk is busy for 400s, and the slow disk is busy for 600s.

- a) What is the response time for jobs in the observed system?
- b) As a function of N , the number of terminals, what are the high-load bounds for throughput and response time?
- c) As a function of N , what are the low-load bounds for throughput and response time?
- d) How many terminals can we support, while keeping the response time below 3 s?
- e) Suppose we plan to replace the CPU with a CPU whose speed is double (thus the time to execute each job would decrease so it becomes 1/2 of the current time). Estimate the number of terminals we can support, with response time below 3s.

f) Propose a design that can support 45 terminals with response time below 3s.

Q3 (2 marks) Imagine you are the lead sysadmin in a large retail company, and that Nick Newbie has joined your workforce after university, where he read a bit about queueing theory. Nick has seen discussions about modelling closed systems, and he wants to model the requests for new customer accounts this way. Write a brief (0.5 to 2 page) explanation for Nick, to say why the handling of account-creation requests should be seen as an open system, and why it matters whether an open or closed system model is used.