CS5224
2005/2006 Semester 1
HW 2

Due: Sep 23, 2005 (Friday)

Notes:

(1) Homework assignment should be done independently though you are allowed to discuss with your fellow students.

(2) You can submit electronically or a hardcopy.

- **a. For electronic submission, set them to chanmc@comp.nus.edu.sg, with subject CS5224 HW2. Also, the file should be named as HW2_{student-id}**
- **b. For hardcopy submission, drop it in the box outside my office. S14, #06-09.**

(3) Remember to write your name.

(4) Late homework will be penalized by 25% every 24 hours.

1. **(15pts)**
   - **a. (10pt) Find the function to generate variables with PDF given by $P(X=x) = a / x^{(a+1)}$**
   - **b. (5pt) Use the answer from part (a) and let a = 2. Generate 1,000 samples and plot the CDF. Compare the CDF of the samples generated to the original CDF.**

2. **(10pt) Compute the max-min fair allocation for sources A,B,C,D and E with demands 2, 3, 4, 4, 5 respectively. The resource size is 15.**

3. **(25pt) Packets A1 of length 200 and B1 of length 100 bits from connections A and B arrive at an empty scheduler at time 0. Packet B2 of length 10 arrives at connection B in real time 1.5 seconds. The line rate is 100 bit/s.**
   (a) In real (or wall clock) time, when do the packets complete service if GPS is used?
   (b) What is the finish number of the packets A1, B1, and B2 if FQ (fair queuing) is used?
   (c) In real (or wall clock) time, when do the packets complete service if FQ is used?
   (d) In real (or wall clock) time, when do the packets complete service if round-robin is used? Assume that packets from connection A are served before B.
   (e) At real time 1s, 2s and 3s, how much service (in bits) is allocated to connections A and B for GPS, FQ and RR?

4. **(25pts) Download the packet trace given in IVLE, with filename "hw2.packet.in". There are 4000 entries/lines from 3 different flows. The**

syntax for each entry is {arrival-time, packet-size, flow-id}. The service rate is 40 units per second.

a. **(10pt) Compute the average and maximum service time for the 3 flows using FIFO. You may need to write a program to compute the answers.**
b. **(15pt) Propose a "fair" algorithm to reduce the maximum service time of flow 2, a delay sensitive application. Compute the average and maximum service time of the proposed algorithm using the packet trace given.**

5. **(25pt) There are two flows (1 and 2) and each flow has a Poisson arrival rate 1 packet/sec. Each flow is served by a server with exponentially distributed service time with mean 0.5 seconds. However, both servers share a common buffer. Let B1 and B2 be maximum amount of packets that can be buffered from flow 1 and flow 2 respectively.**
   a. **(10pt) Draw the state transition diagram for a total buffer size of 5 for the case of B1=B2=5.**
   b. **(5pt) What is the packet loss probability of flow 1 in case (a)?**
   c. **(10pt) Let B1 = 5 and B2 = 3. Compute the loss probabilities of flows 1 and 2.**