PRINCE OF SONGKLA UNIVERSITY

FACULTY OF ENGINEERING

Mid-Term Examination: Semester II Academic Year: 2009

Date: 25 December 2009 Time: 13.30 – 15.30 (2 hrs)

Subject: 241-553 High Speed and Broadband Integrated Networks Room: R300

ทุจริตในการสอบ โทษขั้นต่ำคือ ปรับตกในรายวิชาที่ทุจริต และพักการเรียน 1 ภาคการศึกษา

Instructions

- In this paper exam, there are SEVEN questions, 15 pages, out of 140 marks.
- Try to answer ALL questions.
- Answers could be either in Thai or English.
- Calculators, books, and notes are NOT allowed.

1. Answer the following questions (20 marks):

   1.1 Please describe the mechanism given in Figure 1 what it is used for, and how it works (HUNT Mode, PRESYNC Mode และ SYNCH Mode) (3 marks)

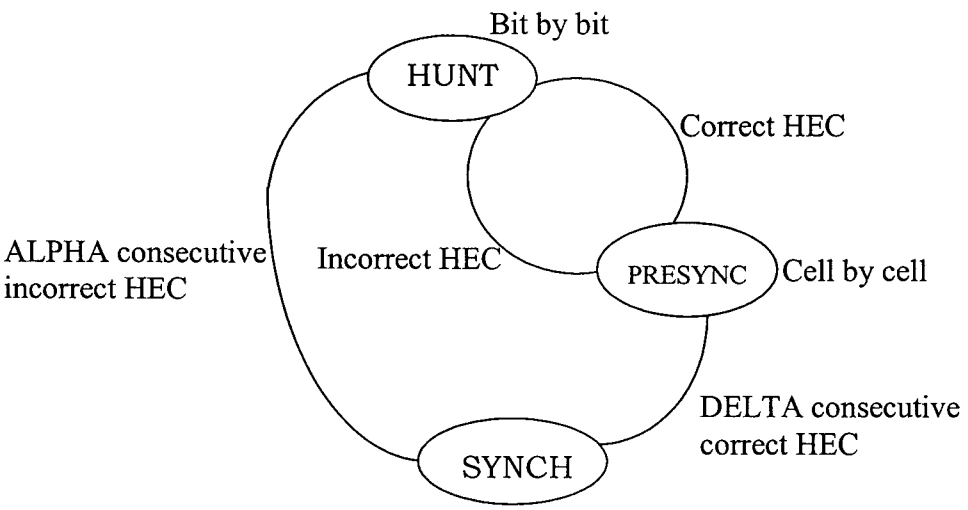

Figure 1 for question 1.1

.....

.....

.....

.....

.....

.....

.....

.....

.....

1.2 What are the differences between (3 marks)

1.2.1 open loop and closed loop flow controls (please show the figures of both mechanisms)

.....

.....

.....

.....

.....

.....

.....

.....

.....

1.2.2 preventive and reactive flow controls (please show the graph of working region of both mechanisms)

.....

.....

.....

.....

.....

.....

.....

.....

.....

1.3 How many VCs and VPs can be carried on ATM network at UNI and NNI per a switch port? What is the maximum number of connections in ATM switch (per port)? (3 marks)

1.4 What are the differences between "space switching" and "time switching" in ATM switch? (3 marks)

1.5 What is Cell Rate Decoupling used for (3 marks)

.....

.....

.....

1.6 Please describe about CDV (Cell Delay Variation) (3 marks)

.....

.....

.....

.....

.....

.....

.....

.....

.....

1.7 Why can ATM be used in LAN, MAN, and WAN? (2 marks)

.....

.....

.....

.....

.....

.....

.....

.....

.....

2. Leaky bucket

2.1 **Leaky bucket without data buffer Scheme** (10 Marks)

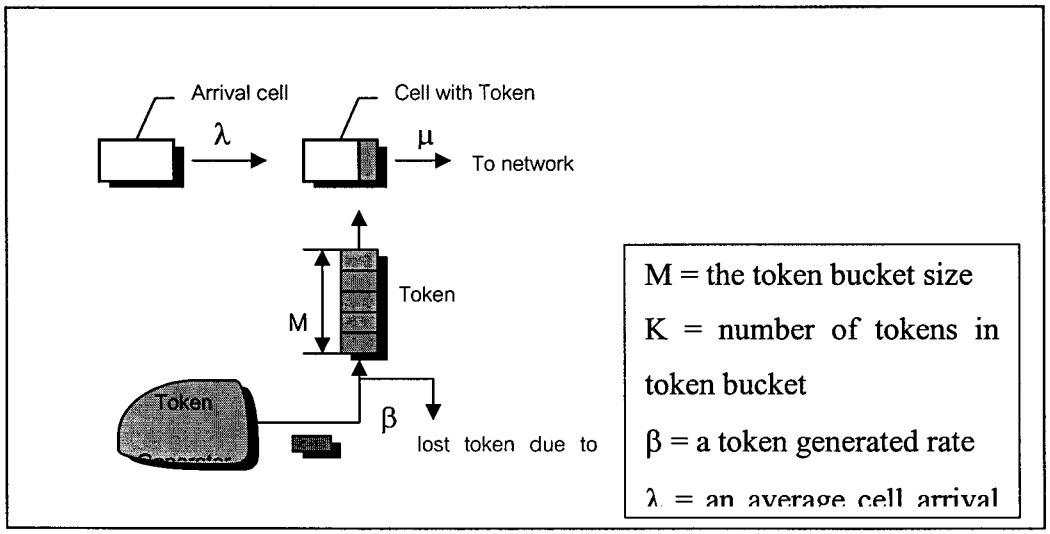

Figure 2 Buffered leaky bucket without data buffer Scheme

Figure 2 shows a *leaky bucket without data buffer or unbuffered leaky bucket without data buffer scheme*. Tokens are generated with rate β and stored in the token bucket which has finite capacity *M*. If the token bucket is full ($\beta T \geq M$) then next token is discared. An arrival cell is placed with a token from the token bucket if the token bucket is not empty otherwise the cell is discarded.

The below figure show arrival cell and token in leaky budget, please draw transmitted cells in the given time slots. Please also state clearly that what cell numbers will be discarded

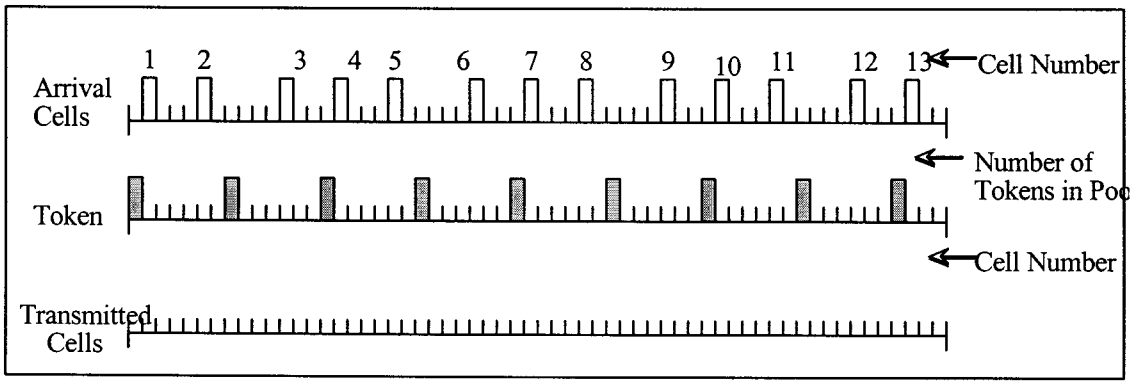

Figure 3 for question 2.1

.....

.....

.....

.....

.....

.....

.....

.....

2.2 Leaky Bucket with data buffer (10 Marks)

Figure 4 shows *leaky bucket with data buffer* or *buffered leaky bucket with data buffer scheme* [A01][A06]. Tokens are generated with rate β and stored in the token bucket which has finite capacity M. If the token bucket is full ($\beta T \geq M$) then next token is discared. An arrival cell from the data buffer is placed and transmitted with μ rate with a token from the token bucket if the token bucket is not empty otherwise the cell is stored in the data buffer which has a finite capacity M if it is not full ($N < M$)and dicareded when it is full ($N \geq M$).

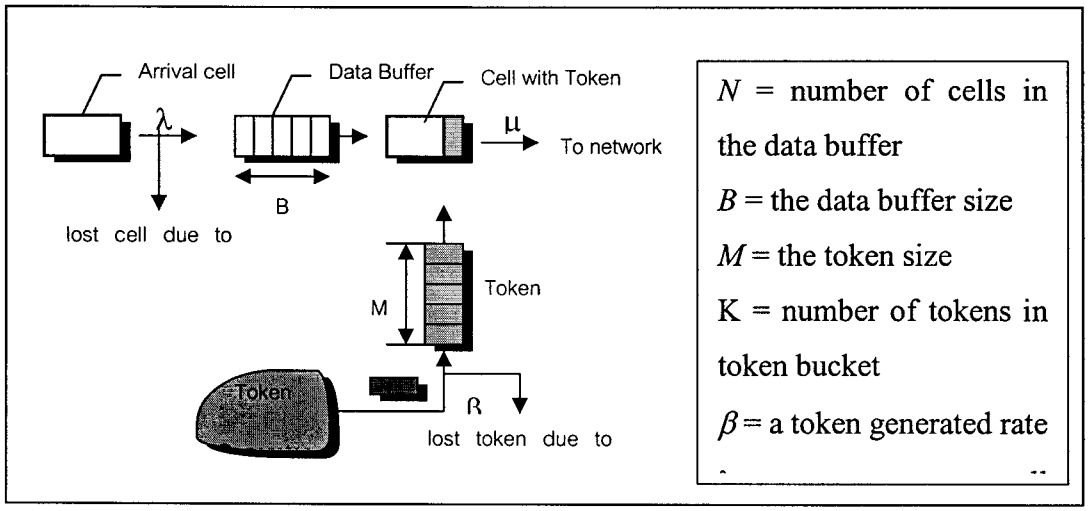

Figure 4 Leaky Bucket with data buffer

The below figure show arrival cell and token in leaky budget, please draw transmitted cells in the given time slots. Please also state clearly that what cell numbers will be discarded.

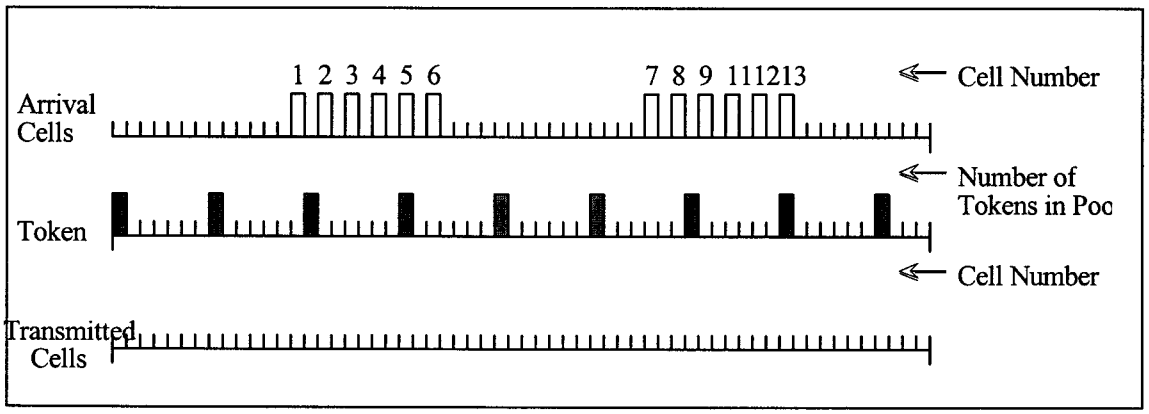

Figure 5 For question 2.2

.....

.....

.....

.....

.....

.....

.....

3. Below is the demonstration diagram of window flow control. Given a window size, W (the time to transmit data) as shown in Figure 6, the maximum transmission rate of the source is determined by the value of W in relation to the round-trip time delay D. If the service rate of the source is 1/R. Please, answer the following questions (20 marks):

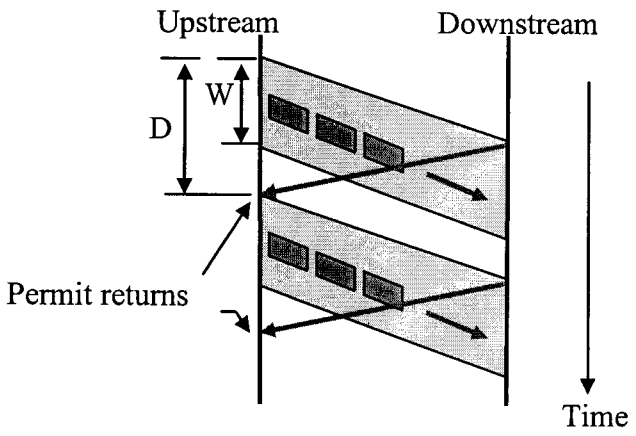

Figure 6 Windows flow control demonstration diagram used for question 3

3.1 What is the maximum rate of information transmission of the source?

3.2 What is the minimum rate of the source (in relation of 1/R, W, and D)?

3.3 From 3.2, what is the maximum rate of the source if W is larger than D?

3.4 What is the optimal value of W?

.....

.....

.....

.....

.....

.....

.....

3.5 Assuming that the time-out mechanism is activated after T. If the acknowledgement signal from downstream is missing. What is the system throughput (in relation of 1/R, W, D, and T)?

.....

.....

.....

.....

.....

.....

.....

4 4.1 In ATM networks, any VCI from a source to a destination may change when it passes any ATM switch in the network. Explain why and how this scenario happens. You should give an example to amplify your answer (10 marks).

4.2 Picture shown below one of LAN emulation working environment. (10 marks)

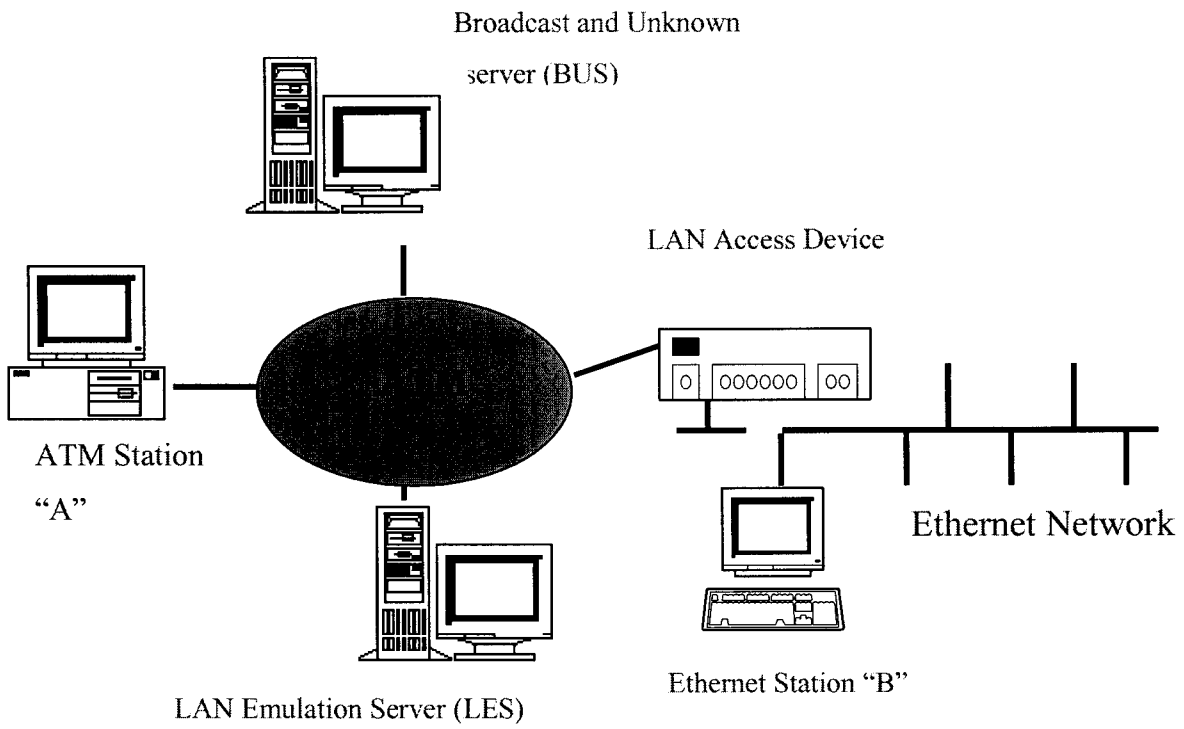

Figure 7 LAN Emulation

Station A would like to connect to station B. However, station A does not know station B's ATM address. Station B is in the sub-net where LAD is the sub-net gateway.

Please describe working steps in to 2 conditions:

a) if LAD has station B's ATM address

b) if LAD has no idea about station B

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

5. Figure 8 shows time slot of CBR traffic. Please state that which ATM cells are conform and non-conform using GCRA (Generic Cell Rate Algorithm) with the following parameters:

T(PCR) = 4 cell time, τ(PCR) = 2 cell time (15 points)

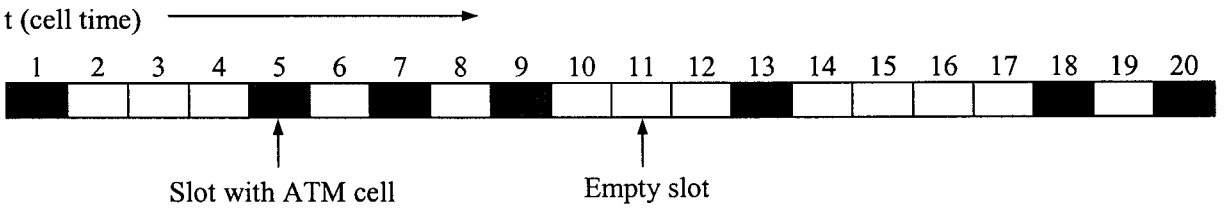

Figure 8 Time slots of CBR

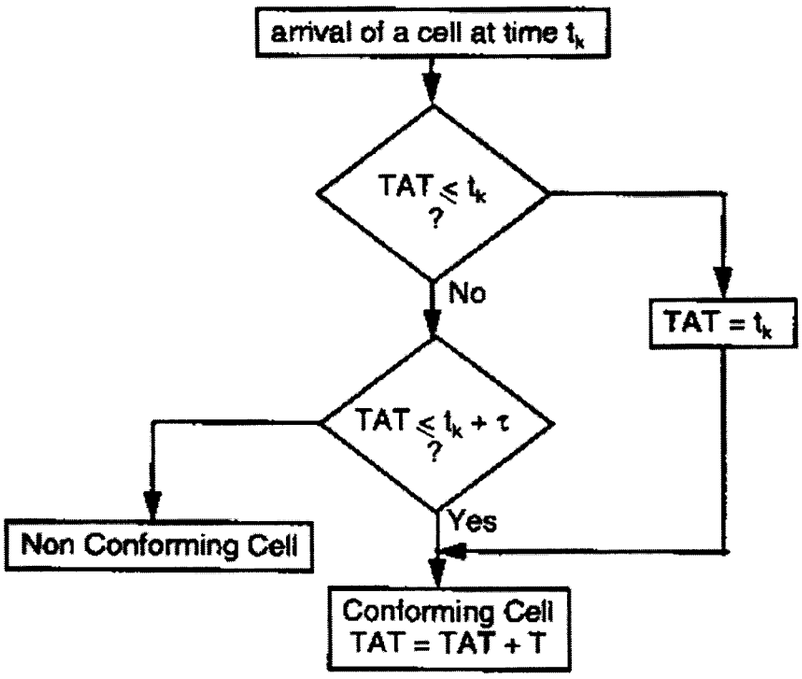

Figure 9 Generic Cell Rate Algorithm

Your answer:

t = 1: TAT = 1, conforming, TAT = 1 +4 = 5

t = 5: _____

t = 7: _____

t = 9: _____

t = 13: _____

t = 18: _____

t = 20: _____

6. Figure 10 shows VBR traffic time slots (in cell time). Please show that which VCR cells are conform and non-conform using Generic Cell Rate Algorithm (GCRA) parameters as follows: (15 points)

   T(PCR) = 1 cell time, τ(PCR) = 0 cell time

   T(SCR) = 4 cell time, τ(SCR) = 3 cell time

   MBS = 3 cells

   (15 points)

6. Compute the maximum delay $D \leq Req\_Buf/PCR_o$.

In our system the out-going link bandwidth is 155 Mbps. There are four types of sources tested in our system with the following source traffic parameters:

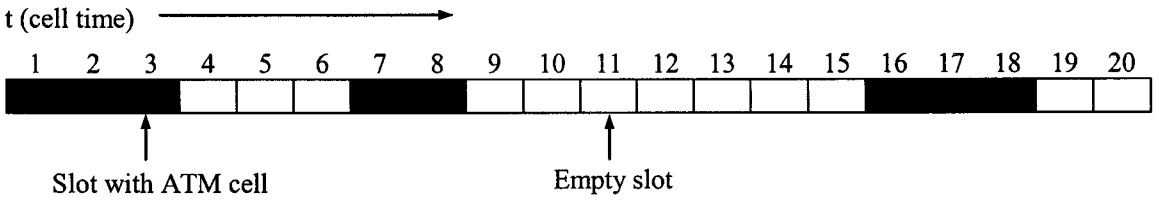

Figure 10 VCR traffic arrival time

Your answer (for PCR):

t = 1: TAT = __, conforming, TAT = _____

t = 2: _____

t = 3: _____

t = 7: _____

t = 8: _____

t = 16: _____

t = 17: _____

t = 18: _____

Your answer (for SCR):

t = 1: TAT = __, conforming, TAT = _____

t = 2: _____

t = 3: _____

t = 7: _____

t = 8: _____

t = 16: _____

t = 17: _____

t = 18: _____

7 The following steps are the rule for worst case allocation for VBR VCs (20 Marks):

1. Assume that all connections are compliant with GCRA(1/PCR,0) and GCRA(1/SCR,τ_s),
2. Determine N, the maximum number of source NxSCR ≤ PCR,
3. Find out the worst case for one source with MBS = integer [1+τ_s/(1/SCR – 1/PCR))],
4. Assume that all sources are synchronised and transmit their worst case traffic,
5. Find the buffer size to avoid any overflow Req_Buf= (N-PCR$_o$/PCR) x MBS,
6. Compute the maximum delay D ≤ Req_Buf/PCR$_o$.

In our system the out-going link bandwidth is 155 Mbps. There are four types of sources tested in our system with the following source traffic parameters:

Type A: MSB = 200 cells, SCR = 5,000 cells/sec, PCR = 25 MBPS

Type B: MSB = 200 cells, SCR = 5,000 cells/sec, PCR = 155 MBPS

Type C: MBS = 1,000 cells, SCR = 15,000 cells/sec, PCR = 59,000 cells/sec

Type D: MBS = 1,000 cells. SCR = 15,000 cells/sec, PCR = 367,000 cells/sec

The following contact parameters are given

For peak rate: GCRA(1,0) and

For average rate: GCRA (3,8)

Please determine (you must show how you get the answer).:

a) Maximum number of connections
b) Minimum buffer size

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....