

PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Mid-Term Examination: Semester I

Academic Year: 2007

Date: 4 August 2007

Time: 09.00 – 12.00

Subject: 240-543 Broadband Integrated Networks

Room: หัวหูน

ทฤษฎีในการสอบ โทษขั้นต่ำคือ ปรับตกในรายวิชาที่ทฤษฎี และพักการเรียน 1 ภาคการศึกษา

Instructions

- In this paper exam, there are SEVEN questions, 8 pages, out of 130 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)

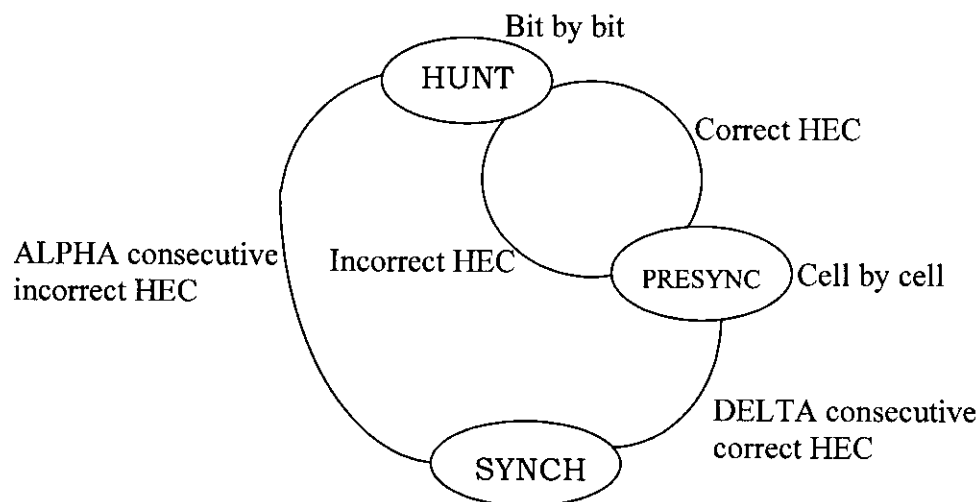


Figure 1 for question 1.1

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 There are 4 nodes in the communication system as shown in Figure 2 (A). Node A and B transmit data by using router R to deliver traffic to their destination nodes C and D respectively. Only a single buffer is provided in R (traffic from A and B are stored into the same buffer). The service discipline of R is first-come-first-serve. The link bandwidth, which is a normalised value and indicated by C, are 10, 1, 2, 1 for the link A-R, B-R, R-C, and R-D, respectively. Node B is a fixed transmission rate source while A is a variable rate source. Node A is able to vary its transmission rate, f , up to 8, where f is a linear increment function. Node B transmits data first until time zero then node A inserts its traffic. From the given graph in Figure 2 (B), answer the following questions (please explain clearly) (20 marks):
- 2.1 Explain what, why, and how (a),(b),(c) and (d) happen,
- 2.2 Give the normalised values in (e) and (f). Please show how you get such figures,

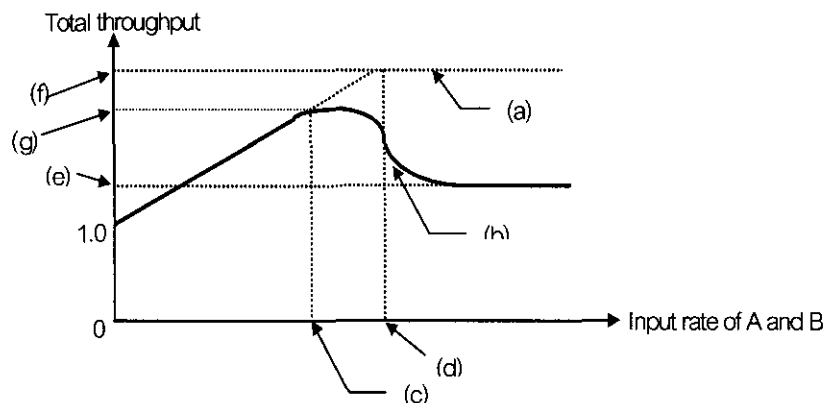
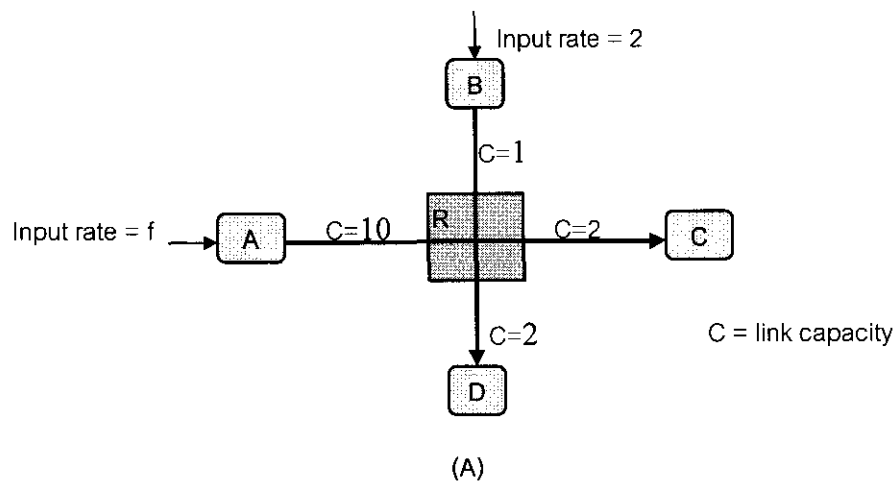


Figure 2 Figure (A) and (B) used for question 2.

3. Below is the demonstration diagram of window flow control. Given a window size, W (the time to transmit data) as shown in Figure 3, 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):

- 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)?

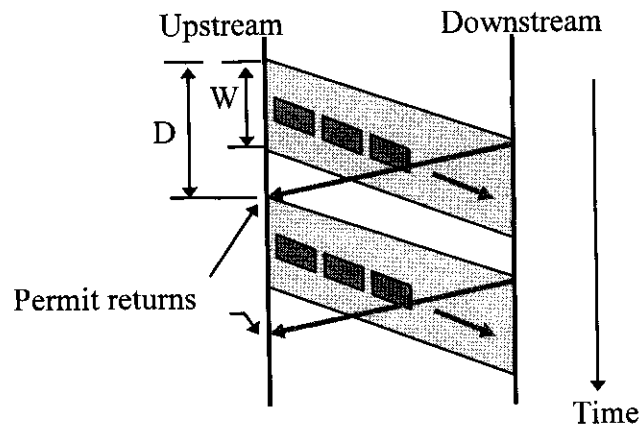


Figure 3 Windows flow control demonstration diagram used for question 3

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)

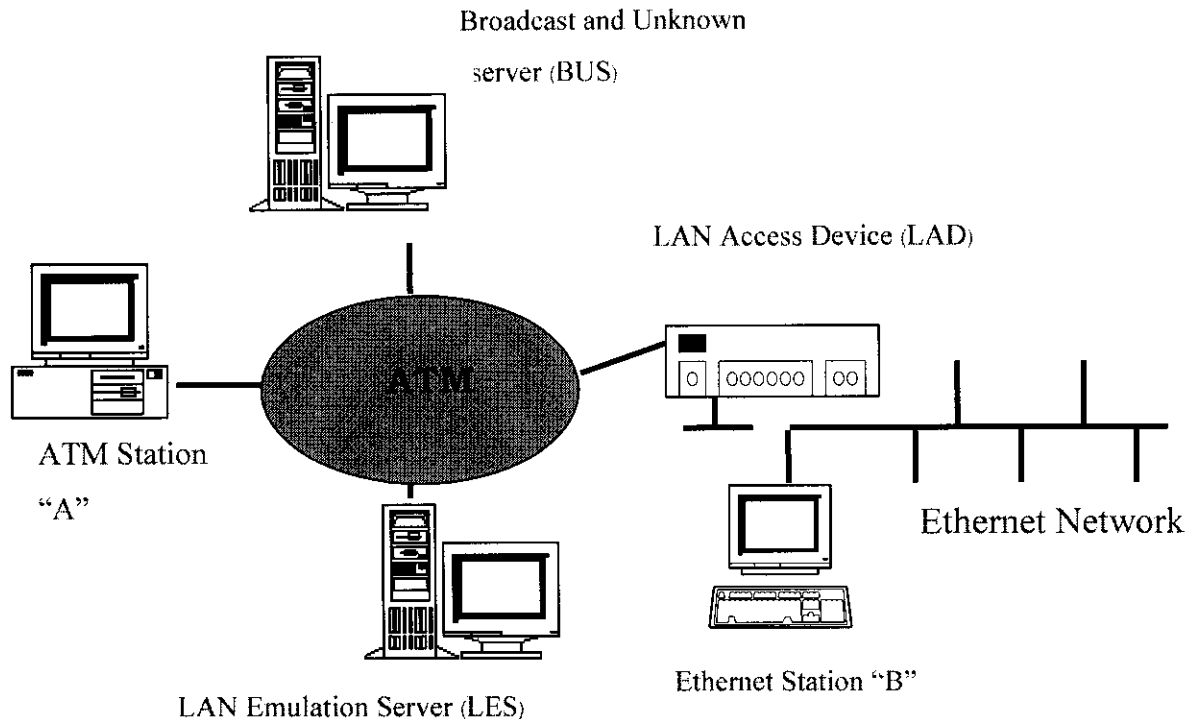


Figure 4 LAN Emulation

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. The following are flow control schemes of ATM (figure 4 to 6). Please explain each scheme clearly, how it works, what the main advantages and drawbacks are (20 marks).

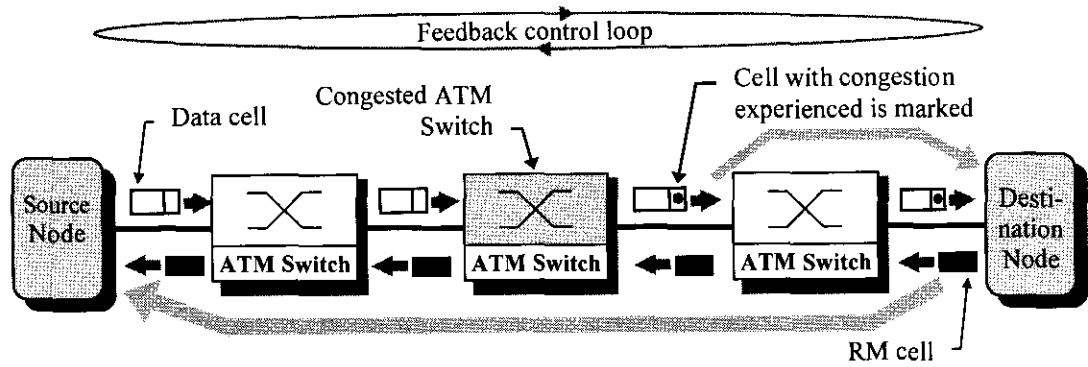


Figure 5 Forward Explicit Congestion Notification (FECN) Scheme

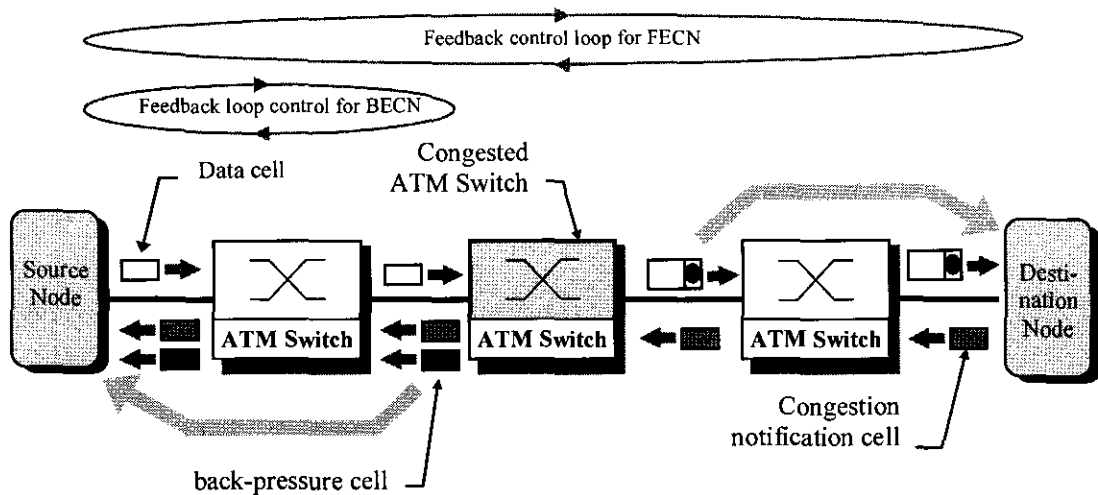


Figure 6 FECN with link-by-link back-pressure per virtual channel rate-based flow control

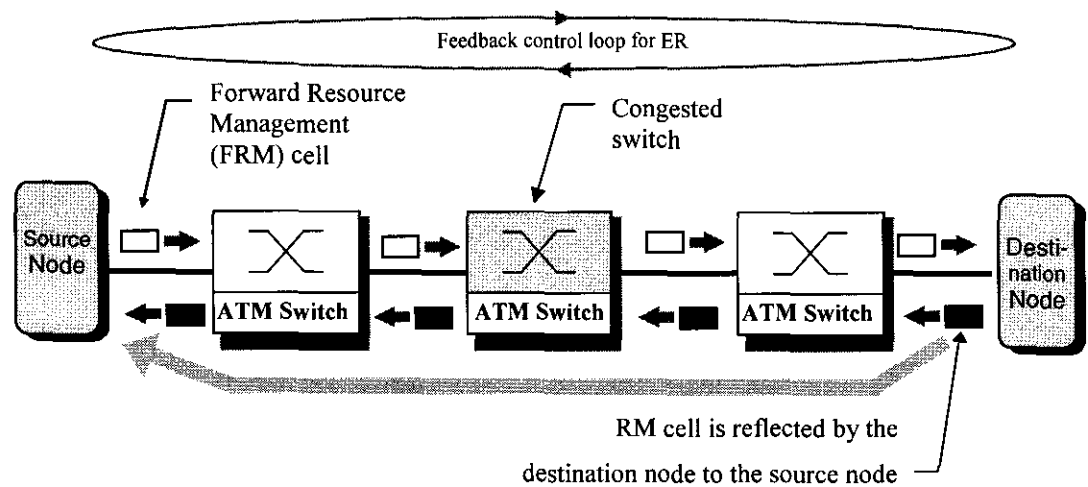


Figure 7 Explicit rate (ER) scheme

6. 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:

$T(\text{PCR}) = 4$ cell time, $\tau(\text{PCR}) = 2$ cell time (15 points)

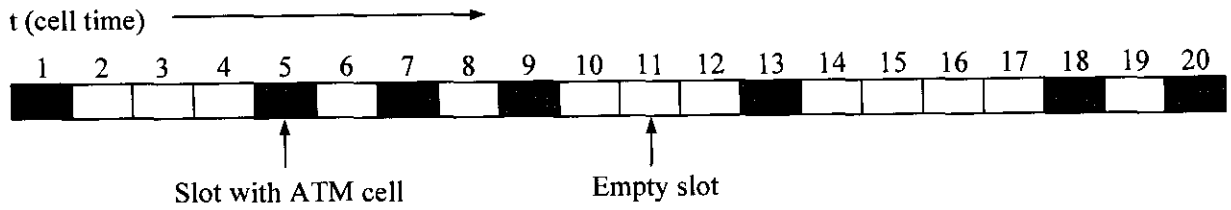


Figure 8 Time slots of CBR

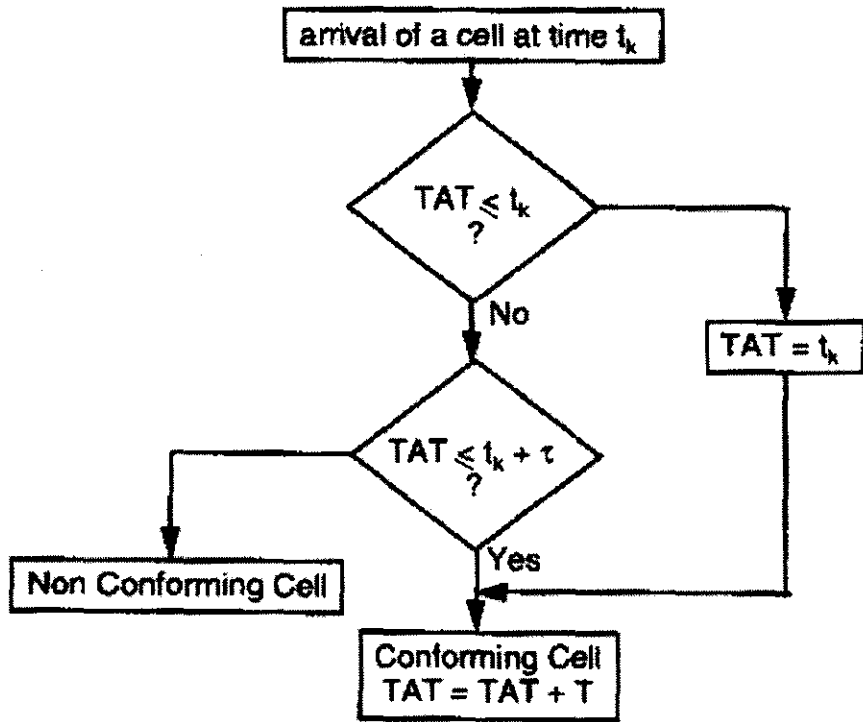


Figure 9 Generic Cell Rate Algorithm

Your answer:

- t = 1: TAT = 1, conforming, TAT = 1 + 4 = 5
- t = 5: _____
- t = 7: _____
- t = 9: _____
- t = 13: _____
- t = 18: _____
- t = 20: _____

7. 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)

$T(\text{PCR}) = 1$ cell time, $\tau(\text{PCR}) = 0$ cell time

$T(\text{SCR}) = 4$ cell time, $\tau(\text{SCR}) = 3$ cell time

MBS = 3 cells

(15 points)

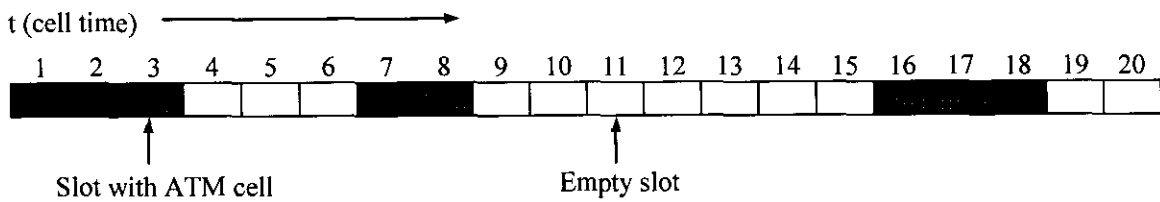


Figure 10 VCR traffic arrival time

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: _____