



Institute of Information Technology
Jahangirnagar University

3rd Year 1st Semester B.Sc.(Hons.) Final Examination, 2018
Course Code: IT-3101, Course Title: Database Management System

Total Marks: 60

Time: 3 Hours

Answer any five (5) from the following questions. Figures at the right indicate the marks.

1. a) Construct an ER diagram based on the following scenario using proper cardinality mapping. 8.0

Consider a Hotel Reservation System where customers can reserve rooms. A customer can book many rooms in his/ her name. There are different categories of rooms. Customers can make an initial booking for rooms for certain days. An official approves the booking after getting the booking money from the customers which will again be cleared by Hotel Manager. The customer then checks into the hotel in their booked rooms and clears full payments before leaving the room. Customers need to make payment differently in case of using other facilities like food, swimming pool etc. The official releases the room when customer leaves. After leaving the room hotel staff cleans entire room and gets that ready for next customer.

- b) Explain the following: 4.0
i. Strong and Weak Entity Set
ii. Participation of an Entity Set in a Relationship Set

2. a) Convert the ER diagram you have drawn in 1. a into a relational model. 5.0
b) Define the concept of aggregation. Give two examples where this concept is useful. 3.0
c) In which situation a Composite key is considered in Relational Database Management Systems? Explain with example. 2.0
d) Identify the differences between full functional dependency and partial functional dependency with illustration. 2.0

3. a) What are various types of keys in DBMS. Explain each type with example. 4.0
b) Consider the following relation of BloodDonor: 6.0

Branch-ID	Donor-ID	Name	Address	Area	Blood-Group	Phone
CTG-03	CT_D_1	Asifur	ChadgaonR/A	Chittagong	A+	7116557
CTG-03	CT_D_5	Labiba	ChadgaonR/A	Chittagong	O+	7116577
SYL-02	SY_D_7	Asif	Shah Paran	Sylhet	A-	7116547
CTG-03	CT_D_9	Afrin	AgrabadR/A	Chittagong	AB+	7116567

Find out whether each of the following set of attributes is a key for **BloodDonor** or not, indicating the type of key it is and also write a brief explanation for each answer supporting your answer:

{Branch-ID}, {Donor-ID}, {Branch-ID, Donor-ID}, {Name}, {Name, Address, Branch-ID, Donor-ID}, {Name, Address, Blood-Group}, {Donor-ID, Branch-ID, Blood-Group}, {Donor-ID, Name, Phone}, {Donor-ID, Branch-ID, Phone}, {Branch-ID, Donor-ID, Area}, {Branch-ID, DonorID, Address}, {Branch-ID, Donor-ID, Address, Area}

- c) Differentiate between **primary key** and **foreign key**. 2.0

- A. a) Consider the following relational schema (Super Shop): 10.0

SuperShop (Shop_Id, Shop_name, Branch, Address, Branch_Phone, Branch_Mail)

Customer (C_Id, C_name, C_Address, C_Phone)

Items (Item_Id, Item_name, Type, UnitPrice)

Salesman (Sale_Id, Sale_Name, Counter, Shop_Id)

Purchase (C_Id, Item_Id, Quantity, TotalPrice, PaymentType, Date, Shop_Id, Sale_Id)

Based on the above Relations answer the statements using SQL.

- a) Find out the name of those salesmen who attended the customers with ID “C1” and “C2”.
- b) Find out those item names which are of the same type as “Surf-Excel”.
- c) Find out name of those purchase products which have quantity greater than 5 on 25.02.2019.
- d) Create a view named “Unit-Price” to store the unit price of each item.
- e) Find out total number of salesman available at each shop and rename the resultant column as “AvailableSalesman”.
- f) Find out name of those customers who purchased more in amount than customers with ID “C1” and “C2”.
- g) Find out Customer name and Item name of those records which have more than 10 in quantity in purchase.
- h) Find out name of those salesmen who sold **dairy** and **grocery** products.
- i) Find out the phone number of that customer who purchased products worth of Tk.2050 in cash on “26.02.2019”

j) Add a new attribute **Sale_Phone** to **Salesman** table and insert the phone number “0167-1111111” to the record with **Sale_Id**“S5”.

- b) What are the reasons to introduce null values in database? 2.0

5. a) Consider the following relational schema (Bidding System): 6.0

Buyer (B_Id, B_name, B_Account_number, B_Phone)

Seller (S_Id, S_name, S_Account_number, S_Phone)

Items (Item_Id, Item_name, Type, Price, Quantity, S_Id, B_Id)

Bank (Branch_name, City, Location)

Account (Account_number, Customer_name, Balance, Branch_name)

Write down the Relational Algebraic command to express each of the following queries based on the above scenario:

- a) Find buyer name and Phone number who bought "Sari"
 - b) Find the names of all branches where the average account balance is more than Tk.1,200.
 - c) Find the Item name and price which was bought by "Sakib" and Sold by "Rahim".
 - d) Find out total sale of each item sold by "Rakib".
 - e) Find the minimum and maximum account balance.
 - f) Find out the branch name and city of that branch where total number of accounts in that branch is greater than 100.
- b) One of the following four expressions of relational algebra is not equivalent to the other three on the basis of above scenario. Find out which is not equivalent to the others. 2.0
- $\pi_{S_Id, S_name}(Seller \bowtie Items)$
 - $\pi_{S_Id, S_name}(Seller) \cap (\pi_{S_Id}(Seller) \times \pi_{S_Id}(Items))$
 - $\pi_{S_name, Items.S_Id}(Seller \times Items)$
 - $\pi_{S_Id, S_name}(Seller) \bowtie \pi_{S_Id}(Items)$
- c) Of the following three equivalence's between expressions of relational algebra, which is true? 2.0
- $\pi_{S_Id, B_Id}(Seller \times Buyer) = \pi_{S_Id, B_Id}(Seller)$
 - Seller - Buyer = Buyer - Seller
 - $\pi_{S_Id, B_Id, B_name}(Seller \bowtie Buyer) = \pi_{S_Id, S_name}(Seller) \bowtie \pi_{B_Id, B_name}(Buyer)$
 $S_name=B_name$
 - none of the above (i.e., they are all false)
- d) Which query is more Efficient for the following Statement and why? Explain. 2.0
"Find out the city and location of the account that has Tk.10, 000 balance."

Query:

- $\pi_{City, Location}(\sigma_{Balance='10000'})(Bank * Account)$
- $\pi_{City, Location}(\sigma_{Balance='10000'}(\sigma_{Bank.Branch_name = Account.Branch_name}))^{(Bank * Account)}$
- $\pi_{City, Location}(\sigma_{Balance='10000'})(Bank)$
- $\pi_{City, Location}(\sigma_{Balance='10000"})(Student \bowtie Department)$
 $Bank \quad Account$

6. a) What is normalization and its purpose? Explain different types of normalization with example 5.0
- b) The relation R(A, B, C) has the following functional dependencies: 4.0
- FD1. D → AC
- FD2. A → B

FD3. $B \rightarrow C$

- i) What are the keys of the relation?
 - ii) Show that the relation is not in BCNF and not in 3NF.
 - iii) Decompose the relation into smaller relations that are in BCNF,
 - c) Explain degree of relationships and different types of attributes with examples. 3.0
- 7 a) Explain how does RAID technology work in DBMS? 6.0
- b) Define transaction its properties 2.0
- c) For each of these scenarios: 4.0
- i) A file with 10,000 pages and 3 available buffer pages.
 - ii) A file with 20,000 pages and 5 available buffer pages.
 - iii) A file with 2,000,000 pages and 17 available buffer pages.

Answer the following questions assuming that external merge-sort is used to sort each of the files:

- i) How many runs will you produce on the first pass?
- ii) How many passes will it take to sort the file completely?
- iii) What is the total I/O cost for sorting the file? (measured in #pages read/written)



**Institute of Information Technology
Jahangirnagar University**

THIRD YEAR FIRST SEMESTER B.SC (HONS) FINAL EXAMINATION, 2018
[In Information Technology]

Course Code: IT 3105

Time: 3 Hours

Course Title: Signals & Systems

Full Marks: 60

Answer any **5 (five)** of the following questions. Figures in the right margin indicate marks.

- 1.** a) Show the representation of a system. Mention different types of system **4**
b) Write properties of Linear Time-Invariant systems. **3**
c) A system has the input-output relation given by $y[n] = T\{x[n]\} = nx[n]$. Determine whether the system is (a) memoryless, (b) causal, (c) linear, (d) time-invariant, or (e) stable. **5**

- 2.** a) Show that the complex exponential signal $x(t) = e^{j\omega_0 t}$ is periodic and that its fundamental period is $2\pi/\omega_0$. **4**
b) i. Find the even and odd components of signal $x(t) = \cos(t) + \sin(t) + \sin(t)\cos(t)$. **4**
ii. Consider a discrete-time signal, $x[n] = \begin{cases} 1, & -2 \leq n \leq 2 \\ 0, & |n| > 2 \end{cases}$, Find $y[n] = x[3n-2]$.
c) Sketch the waveform of the following signals: **4**
i. $x(t) = u(t+1) - 2u(t) + u(t-1)$
ii. b) $x(t) = r(t+1) - r(t) + r(t-2)$

- 3. (a)** Find the Fourier coefficient C_n for signal $x(t)$ shown in fig. 1. **3**

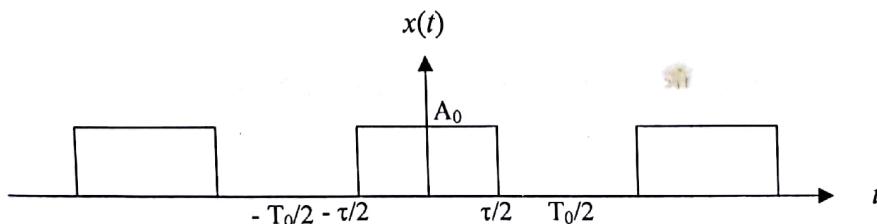


Fig. 1

- b) How Fourier series of any periodic signal can be derive using trigonometric representation? **6**
c) Derive the Parseval's power theorem. **3**

4. a) Express the Fourier transform of a rectangular pulse. If $y(t) = x(t) \cos(\omega t)$ and Fourier transform 6

of $y(t)$ is given as $Y(\omega) = \begin{cases} 2; & |\omega| \leq 2 \\ 0; & \text{otherwise} \end{cases}$; Then find $x(t)$.

b) Write and derive the shifting properties of Fourier transform for both time and frequency 4 domain.

c) Find the Fourier transform of the signal $x(2t-3)$. 2

5. a) Write the properties of Z-transform. 3

b) The Z-transform of a signal is given by $C[Z] = \frac{1z^1(1-z^4)}{4(1-z^{-1})^2}$, Find its final value. 3

c) A finite sequence $x[n]$ is defined as $x[n] = \{5, 3, -2, 0, 4, -3\}$, Find $X(z)$ and its ROC. 3

d) Determine the Z-transform and ROC of $x[n] = -u[-n+1] + \left(\frac{1}{2}\right)^n u[n]$. 3

6. a) What are the various representations of signal? Why is a signal converted from one 3 representation to another?

b) If $x(t)$ is an integrable continuous-time signal, then write the equation of Fourier transform $X(\omega)$ 3 of this signal. How $x(t)$ can be constructed from $X(\omega)$?

c) Briefly explain the following properties of Fourier transform: 4

- i) Time Scaling
- ii) Time Reversal

d) What is the significant of impulse response (IR) for LTI system? 2

7. a) Determine the Laplace transform of the following functions: 4

i) $h(t) = e^{2t} + \cos(6t) + 3\sin(2t)$

ii) $x(t) = 5e^{-4t} + 4\cos(3t) + 9\sin(3t)$

b) Determine the inverse Laplace transforms of the functions given below: 4

i) $F(s) = \frac{6s}{s^2+25} + \frac{3}{s^2+25}$

ii) $H(s) = \frac{19}{s+2} - \frac{1}{3s-5} + \frac{7}{s^5}$

c) Show that the z-transform of $x[n] = \cos(an)$ is $X(z) = \frac{z(z-\cos(a))}{(z^2-2\cos(a)z+1)}$ 4 (where a is a real number)



INSTITUTE OF INFORMATION TECHNOLOGY

JAHANGIRNAGAR UNIVERSITY

3RD YEAR 2ND SEMESTER BSC IN INFORMATION TECHNOLOGY

Final Examination 2018

Course Code: IT 3107

Course Title: Operating System

Session 2015-2016

Time Allowed: 3 Hours

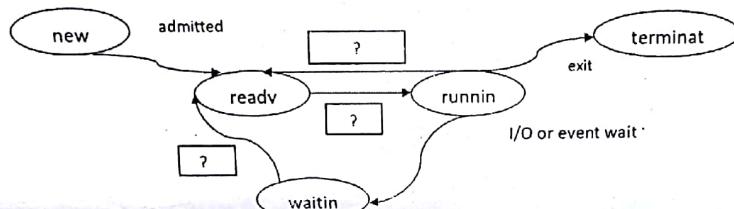
Full Marks: 60

Do not write anything in the question script.

There are seven questions. Answer any five of them.

Figures in the right margin indicate marks.

1.
 - (a) Define operating system through user and system view. [3]
 - (b) How to distinguish certain tasks that are whether in user mode or kernel mode? [3]
 - (c) Draw the block-diagram of process control block. [3]
 - (d) For the diagram of process state, Fill the blank-box? [3]



2.
 - (a) What are the difference of asymmetric and symmetric multi-processing? [4]
 - (b) Draw a symmetric multiprocessing architecture. [3]
 - (c) What are the operating system services? [3]
 - (d) Mention the different types of system calls. [2]
3.
 - (a) What is micro-kernel? Draw the Android Architecture. [3]
 - (b) What do you understand by thread? Discuss the types of scheduler. [3]
 - (c) Draw and discuss the medium term scheduling diagram. [2]
 - (d) Explain the concept of context switching. [1]
 - (e) Mention the steps that can terminate a process. [1]
 - (f) What is independent and co-operative process? [2]
4.
 - (a) Draw the multi-threaded models. [2]
 - (b) Define Throughput; Waiting time and Socket [3]
 - (c) What is concurrency and parallelism? [2]
 - (d) What are the approaches of thread cancellations? [2]
 - (e) Priority Scheduling: (Table 1) [3]

Process	Arrival	Burst time	Priority
P_1		10	3
P_2		4	1
P_3		2	2
P_4		6	5
P_5		5	4

Table 1: Question 4(e)

Draw the Gantt Chart and find average waiting time.

5. (a) Explain the concept of deadlock in operating systems? [2]
- (b) Mention the necessary conditions which must hold for deadlock. [2]
- (c) What is the difference between deadlock and starvation? [2]
- (d) Discuss the dining philosopher problem. [2]
- (e) Mention several ways to get rid of dining Philosopher problem. [1]
- (f) Round Robin Time Quantum=6 (Table 2) [3]

Process	Burst time
P_1	24
P_2	10
P_3	14
P_4	7

Table 2: Question 5(f)

Draw the Gantt Chart.

6. (a) What is safe state? Discuss the safety algorithm. [3]
- (b) Explain the necessary steps to avoid deadlock. [2]
- (c) Explain the Banker's algorithm. [3]
- (d) Consider a system with 5 processes and resources as follows: [4]

5 processes P_0 through P_4 ;

3 resource types.

A(11 instances), B(6 instances), and C(9 instances)

Snapshot at time T_0 (Table 3)

8

Is it in safe state?

Request (2,3,0) by P_4 and (0,2,2) by P_0 is granted or not?

Allocation	Max	Available
	ABC	ABC
P_0	010	753
P_1	200	322
P_2	302	902
P_3	211	222
P_4	002	433

Table 3: Question 6(d)

7. (a) Consider the following Segment Table (Table 4). [2]

Segment	Base	Length
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1952	96

Table 4: Question 7(a)

What are the Physical Address for the Logical Addresses: (i) 0, 430; (ii) 1, 10; (iii) 2, 500; (iv) 3, 400; (v) 4, 112. In addition, show how you find the actual result.

- (b) Consider a 64-bit Logical Address Space i. Given Page size of 4 KB Find out the Number of Page Table Entries? ii. If each entry is 16 bytes Find out the Size of the Page Table. [3]
- (c) Consider Three level Page Table Scheme, where logical address space is 64 bit. [3]
- i. If Page size is 4 KB, then find out the Offset size?
- ii. If 2nd outer page size is 32 then find out inner and outer page size?



INSTITUTE OF INFORMATION TECHNOLOGY
JAHANGIRNAGAR UNIVERSITY
3RD YEAR 2ND SEMESTER B. SC. IN INFORMATION TECHNOLOGY
1st

Final Examination 2018

Course Code: IT 3109

Course Title: Simulation and Modeling

Session 2015-2016

Time Allowed: 3 Hours

Full Marks: 60

Do not write anything in the question script.

There are seven questions. Answer any five of them.

Figures in the right margin indicate marks.

1. (a) What is simulation? Explain why do we need to use simulation? [4]
(b) Briefly state the procedure of simulation [4]
(c) Give some examples where simulation is used to conduct research or operations [4]
2. (a) When is a system called Single Queue Single Server System? Explain it with an example. [4]
(b) Suppose virtual customers are arrived with the following inter-arrival time and service time:
 $A_1 = 0.4, S_1 = 2.0; A_2 = 1.2, S_2 = 0.7; A_3 = 0.5, S_3 = 0.2;$
 $A_4 = 1.7, S_4 = 1.1; A_5 = 0.2, A_6 = 1.4, A_7 = 1.9$
If $Q(t)$ is the queue length at the time t and $B(t)$ is the busy function against t . Construction area under $Q(t)$ and $B(t)$.
(c) Calculate expected utilization of the server $u(n)$ and comment on the result. [4]
3. (a) Define Negative Binomial Distribution and geometric distribution. Write the application of these distribution in simulation. [4]
(b) Chi-square Goodness of fit test is widely use after a simulation performed, what are the processes of conduction this test and why do researchers use this test? [4]
(c) What are the application of Q-Q and P-P plot? Construct a Q-Q plots for the inter arrival time of customers 10, 12, 18, 22 in seconds. [4]
4. (a) What is Monte Carlo Simulation? Explain briefly three basic types of parameters to describe the distribution. [4]
(b) Explain method of moments and Maximum Likelihood Estimator. [4]
(c) Consider an M/M/1 queuing system with an inter arrival rate 0.03 and service rate 0.6. Compute the system load and show that the system is stable or not? [4]

5. (a) Consider the grocery store with one checkout counter. Prepare the simulation table for four customers and find out average delay in queue, the time-average number of customers in queue, and the proportion of time the server is busy. The inter arrival time (IAT) and the service time (ST) are given in minutes. [10]
- IAT: 0.4, 1.2, 0.5, 1.7, 0.2, 1.6, 0.2, 1.4, 1.9
 ST: 2.0, 0.7, 0.2, 1.1, 3.7, 0.6
- Assume first customer arrives at $t = 0$.
- (b) For a single server queuing system, suppose that we did not want to estimate the expected average delay in queue; the model structure and parameters remain the same. Does this change the state variables? If so, how? [2]
6. (a) Describe the evaluation of the following queuing system by a Markov chain. [5]
 i) M/M/ ∞ Queue ii) M/M/m Queue iii) M/M/m/m Queue
- (b) Consider a random variable X which takes on values 1 and 2 with probability 0.25 and 0.75, respectively (i.e., $Pr[x = 1] = 0.25$ and $Pr[x = 2] = 0.75$). Determine the mean and variance of X . Plot the probability density function (pdf) and probability distribution function (PDF) of X . [5]
- (c) What properties should random numbers have? [2]
7. (a) What is a confidence interval? How can the width of a confidence interval be reduced? [2]
- (b) Explain the following heuristic procedures for comparing fitted distributions with the true underlying distribution. [4]
 i) Density-Histogram Plots
 ii) Comparison Frequency
- (c) A professor wants to find out students monthly income during summer vacation. Past year figures shows that the mean and variance are Tk.8000 and Tk.400 respectively. The professor thus hypothesizes the mean as Tk.8000, and Tk.400 respectively. After the vacation, the professor wants to verify if his hypothesis is correct, and adopts a significance level (α) of 0.05 in testing. He selects 100 students from population, and record down their salary. The sample mean among these 100 students is Tk. 7,800. (Consider, z (the number of S.D. deviated from the mean) = 1.96 for the value of 0.975). How do you test the hypothesis of the professor? [6]



INSTITUTE OF INFORMATION TECHNOLOGY
JAHANGIRNAGAR UNIVERSITY
3RD YEAR 2ND SEMESTER BSC IN INFORMATION TECHNOLOGY

Final Examination 2018

Course Code: IT 3103

Course Title: Computer Network & Internet Technology

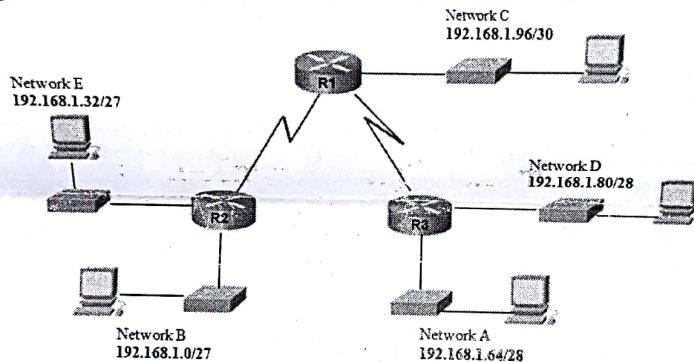
Session 2015-2016

Time Allowed: 3 Hours

Full Marks: 60

Do not write anything in the question script.
There are seven questions. Answer any five of them.
Figures in the right margin indicate marks.

1. (a) Distinguish between various types of devices used in traditional computer network [2]
(b) You have given three LANs connected to each other with two WAN links (as shown in Figure). An ISP allocated 192.168.1.0/24, there are 50 hosts connected to R1, 30 hosts connected to R2 and 30 hosts connected to R3. [9]



Find the Network addresses, Gateway addresses; Usable IP addresses; Broadcast addresses; Total address spaces; Network Masks for R1, R2 and R3.

- (c) What is the difference between a front address, a logical address, and a physical address? [1]
2. (a) Suppose you are sending an email from your gmail account to your friend, who reads his/her e-mail from his/her mail server using IMAP. Briefly describe how your email travels from your host to your friends host. Explain it using illustrations. Also, what are the application layer protocols involved? [6]
- (b) Describe the message format and the message transfer and the underlying protocol involved in the working of the email. [3]
- (c) Distinguish between ICMP and ARP protocols. [3]
3. (a) Suppose users share a 2 Mbps link. Also suppose each user transmits continuously at 1 Mbps when transmitting, but each user transmit only 20 percent of the time.
(i) When circuit switching is used, how many users can be supported?
(ii) Suppose packet switching is used. Why will there be essentially no queuing delay before the link if two or fewer users transmit at the same time? [4]
- (b) Suppose that between a sending host and a receiving host there is exactly one packet switch. The transmission rates between the sending host and the switch and between the switch and the receiving host are R₁ and R₂, respectively. Assuming that the router uses store-and-forward packet switching, what is the total end-to-end delay to send a packet of length L. (Ignore queuing and propagation delay). [4]

- (c) Consider an application which transmits data at a steady rate (e.g., the sender generates a N bit unit of data every k time units, where k is small and fixed). Also, when such an application starts, it will stay on for relatively long period of time. Answer the following questions, briefly justifying your answer: [4]
- i) Would a packet-switched network or a circuit-switched network be more appropriate for this application? Why?
 - ii) Suppose that a packet-switching network is used and the only traffic in this network comes from such applications as described above. Furthermore, assume that the sum of the application data rates is less than the capacities of each and every link. Is some form of congestion control needed? Why?
4. (a) Suppose you have taken every possible prevention to save your host computer from malware. But even prevention method was not enough and your host is under attack. Briefly describe how many different ways these attacks can happen. [4]
- (b) Suppose you want to do a transaction from a remote client to a server as fast as possible. What transport layer protocol you would use and why? [3]
- (c) From a users perspective what is the difference between the download-and-delete mode and the download-and-keep mode in POP3? [3]
- (d) The application developer has control of everything on the application-layer side of the socket but has little control of the transport-layer side of the socket. What control does a developer has on transport-layer side of the socket? [2]
5. (a) Suppose you want to send a file to your friend and you are using TCP protocol for reliability. Briefly describe the procedure that TCP must follow before sending the real data. [6]
- (b) Suppose you are located in Dhaka and your friend is located in Savar. The round-trip propagation delay between these two end systems is approximately 30ms. Suppose you two are connected by a channel with a transmission rate of 1 Gbps. With a packet size of 1000 bytes including both header and data, what will be the actual time needed to transmit a packet from your place to your friends place using the existing channel? If you are using the stop-and-wait protocol then during the entire period of time how much time you are actually wasting for acknowledgment? [6]
6. (a) What is the difference between packet forwarding and packet routing? [2]
- (b) Briefly describe what services a network layer protocol can provide to its lower layer? Among all these protocols which are taken by IP and why? [6]
- (c) Why down TCP and IP both perform packet error checking at both transport and network layer? [4]
7. (a) Suppose you purchase a wireless router and connect it to your cable model. Also suppose that your ISP dynamically assigns your connected devices one IP address. Also suppose that you have five PCs? Does the wireless router use NAT? Why or why not? [6]
- (b) Briefly describe how DSCP protocol works? [6]