Institute of Information Technology
Jahangirnagar University
3rd Year 1st Semester B.Sc.(Hons.) Final Examination, 2019
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) What is Database Management System (DBMS)? Discuss the reasons for the three-level architecture (external, conceptual and internal) for a DBMS. **4.0**

   b) A weak entity set can always be made into a strong entity set. How? What sort of redundancy will result if we do so? **3.0**

   c) List two reasons why null values might be introduced into the database. **2.0**

   d) What is the difference between physical data independence and logical data independence? **3.0**

2. a) Convert the following diagram into a relational model. **6.0**
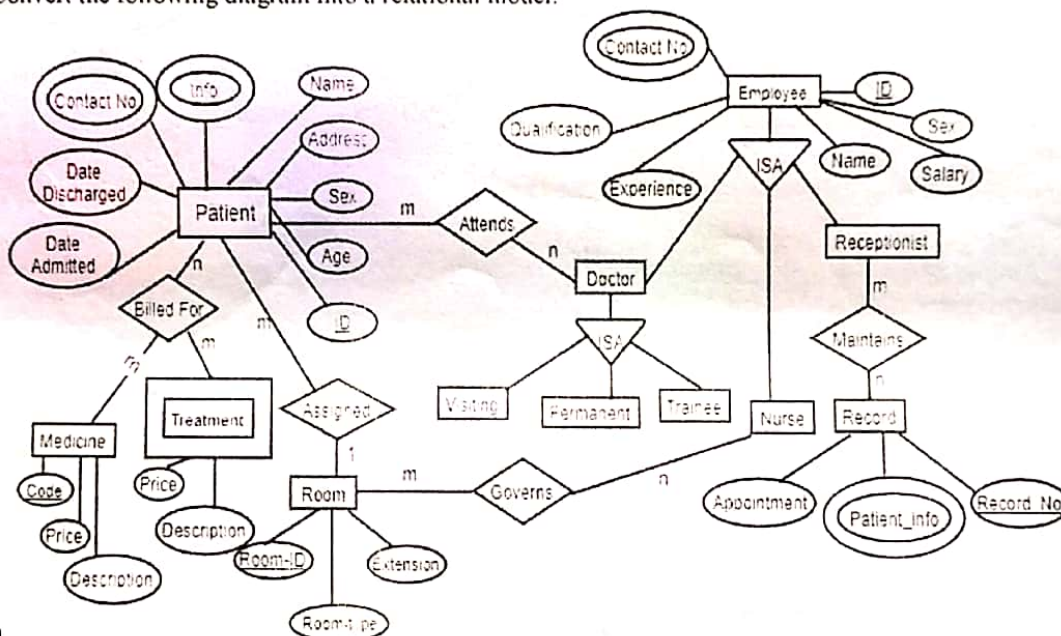
   b) What is a **category** used for? Illustrate your answer with examples. How does a category differ from a regular shared subclass? **4.0**

   c) When is the concept of specialization/ generalization applied in data modeling? **2.0**

3. a) Consider the following relational schema(Customer_Order):

Customer (Cust_Id, Cust_name, Cust_Country, Cust_Address , Cust_Phone)
Order (O_Id, Date, Purchase_Amount, Cust_Id)
Items (Item_Id, Item_name, Type, UnitPrice, AvailableQuantity)
Contains (Item_Id, O_Id, Quantity)
Supplier (Sup_Id, Sup_Name, Sup_Phone, Sup_Address)
Supplies (Sup_Id, Item_Id, unitCost)

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

   i.   Find out the name of those items which have been ordered highest in quantity.
   ii. Find out those customer names who ordered same type of items.
   iii. Find out those orders which have total purchase amount more than Tk. 5000 on 25.11.2019.
   iv. Find out those supplier names who supply grocery products.
   v.   Find out total number of items supplied by every supplier.
   vi. Find out the purchase date and name of that customer who bought products of supplier with id "002" and "004".
   vii. Find the name and unit price of each items supplied by "Square" and "NEC Corporation".
   viii. Find out those customers who don't belong to the same country.

   b) Retrieve the name of those items which have been ordered more than 5 times using **Cartesian product.** **2.0** Then rewrite the query using **JOIN** operation. Which one of the above two operations is more efficient?

   c) How are the **OUTER JOIN** operations different from the **INNER JOIN** operations? **2.0**

4. a) Consider the following relational schema (LIBRARY): **6.0**

Book (Book_Id, Title, PublisherName)
Book_Authors (Book_Id, Author_Name)
Publisher (PublisherName, Address, Phone)
Library_Branch (Branch_Id, Branch_Name, Address)
Book_Copies (Book_Id, Branch_Id, No_Of_Copies)
Book_Loans (Book_Id, Branch_Id, Card_No, DateOut, DueOut)
Member(Card_No, Name, Address, Phone)

Based on the above Relations answer the statements using SQL.

   i.   List the total number of books available in library for every author.
   ii. Find out those member details who haven't borrowed any book yet.
   iii. Retrieve the total no. of copies available of the book "Fundamentals of Database System" in Motijheel branch.
   iv. Delete the records of that member whose card no. is "C005".
   v.   Create a view to retrieve the names and address of those borrowers who have five books checked out.
   vi. Retrieve the author name and publisher name of the book "Fundamentals of Database System".

   b) For each of the following expressions, indicate whether it is a valid SQL statement or not following the **2.0** relation in question 4.a. If invalid, write down the valid statement:

   i.   Select Book_Id or Title from Book;
   ii. Select * from Member where adress= "Agrabad R/A" and Name like "A %"

   c) Explain the concept of Referential Integrity. **2.0**

   d) "A table can be created without Attribute but a tuple". Justify the statement if you agree or not. **2.0**

Consider the following:

INPATIENT BILL(SUMMARY)

Bill Number: 00051
Patient Registration Number:
0012
Patient name: Antara
Patient Address: 29/2, Niketon,
Gulshan-1, Dhaka.
Patient category: Female
Patient Contact: +8802-7000777

Admitting Doctor ID: 121
Admitting Doctor Name: Dr. Fazlul Haque

Bill Date: 25.11.2019

Employee Number: 501
Employee Name: Mokbul
Hossain

Admission Date:
21.11.2019
Discharge Date : 25.11.2019
Total Stay: 4 days

Service Code	Name of Service	Amount(TK.)	Discount(TK.)	VAT(TK.)	Total(TK.)
S001	Single Room	10000.00	0.00	2000.00	12000.00
S002	Surgical Procedure	35000.00	0.00	0.00	35000.00
S004	Pharmacy	5000.00	0.00	0.00	5000.00
S005	Laboratory	8000.00	0.00	0.00	8000.00
S006	Consultation Fee	4000.00	0.00	0.00	4000.00
				Total	64.000.00
				Less	0.00
				Service Charge	1,200.00
				Net payable	65,200.00

a) Transform the above bill into a relational schema. 1.0

b) Find out the anomalies in the derived schema. Explain the effect of the anomalies in brief. 3.0

c) Now normalize the schema up to Third Normal Form. 8.0

4.0

7. a) Write short notes on:

   i. Attribute defined specialization
   ii. Disjointness constraint of specialization

b) What is Data Redundancy? Give an example of a relation which is in 3NF but not in BCNF. 3.0

c) Illustrate the concept of schema and instance with the help of an example. 3.0

d) Differentiate among single valued, multi valued and derived attributes. 2.0

5. a) Let T_1 and T_2 be the following two transactions:

```
T₁: begin
        read(A);
        read(B);
        if A=0, then B:=B+1;
        write(B);
    end


T₂: begin
        read(B);
        read(A);
        if B=0, then A:=A+1;
        write(A);
    end
```
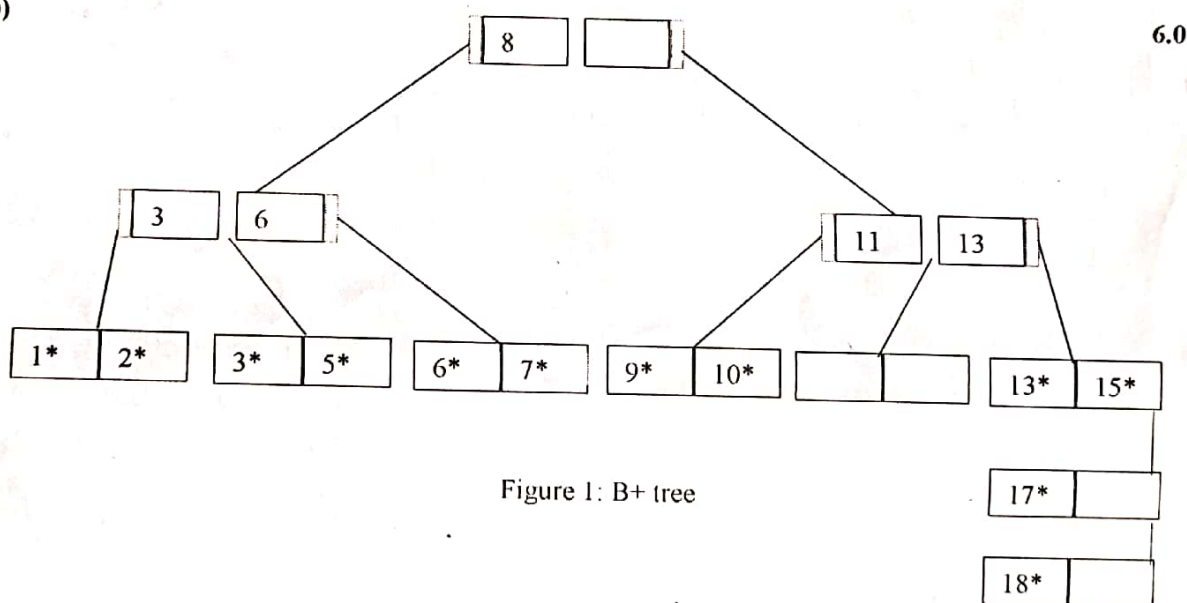
Let the initial values of A and B be 0; and let the consistency requirement be: either A=0 or B=0. Show that every serial execution of these two transactions preserves the consistency of the database.

b)

Figure 1: B+ tree

i) Figure 1 represents a B+ tree. Show the tree after inserting the following elements (16, 17, 18).

ii) Now show tree from part (i) after deleting the following elements: (11, 12, 16). Assume the deletion algorithm tries to merge/redistribute with the right sibling if one exists.

Institute of Information Technology
Jahangirnagar University
3rd Year 1st Semester B.Sc (Hons.) Final Examination, 2019
Subject: Computer Network and Internet Technology
Course Code: IT3103

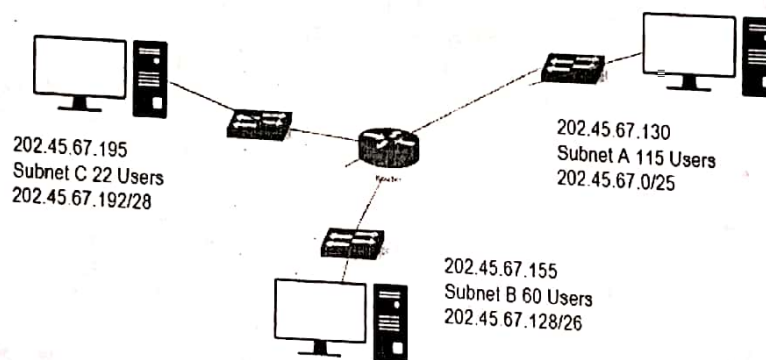Time: 3 Hours   Full Marks: 60

Answer any **Five (05)** from the following questions. Figures at the right indicate the marks.

1. a. Consider an application that transmit data at a steady rate (for example, the   3+3
    sender generates an N-bit unit of data every k time units, where k is small and
    fixed). Also, when such an application starts, it will continue running for a
    relatively long period of time. Answer the following questions, briefly
    justifying your answer:

    i)   Would a packet-switched network or a circuit-switched network be
          more appropriate for the application? Why?
    ii)   Suppose that a packet-switched network is used and the only traffic
          in the network comes from such applications as described above.
          Furthermore, assume that the sum of the application data rate is less
          than the capacities of each and every link. Is some form of
          congestion control needed? Why?

    b. performance at a node is often measured not only in terms of delay, but also in   4
    terms of the probability of packet loss. How? -- Justify.

    c. What is the difference between virus and worm?   2

2. a. What is the advantage of DSL over Dial-up Internet access?   4
    b. Consider a highway that has a tollbooth every 100 km. Suppose that cars travel   4
    on the highway at a rate of 100 km/hour and maintain that speed between
    tollbooths. Suppose next that 10 cars, travelling together as a caravan, follow
    each other in a fixed order. Also suppose that each tollbooth services a car at a
    rate of one care per 12 seconds. Finally suppose whenever the first car of the
    caravan arrives at a tollbooth, it waits at the entrance until the other nine car of
    the caravan arrives at the tollbooth.

    I)   What time will each tollbooth require to push the entire caravan
          onto the highway?
    II)   In this analogy which one is transmission delay and which one is
          propagation delay?

    c. According to the definition, Facebook Messenger should follow P2P   4
    architecture but it cannot follow fully this architecture. Why? Explain.

3. a. Briefly describe what problem arises when Http works with non-persistent   4
    connection.
    b. Describe how web caching can reduce the delay in receiving a requested object.   4
    c. Why Web-based e-mail became popular when IMAP and POP3 were already   4
    there in the market? Who first implemented the concept of Web-based e-mail?

4. a. A IP Address and mask is given by 200.200.200.131/27   6
    (i) What is the address class of the IP address and why?
    (ii) How many subnet is possible with this IP address?
    (iii) What is the maximum number of host of this IP address? Can IIT use this
    IP address scheme?

b. The host has an IP address of 172.16.176.237/19. What are the subnet and broadcast address if the subnet where this host resides? — 6

5. a. Briefly describe TCP's connection management process. — 6
   b. What is the problem of TCP's flow control mechanism? How this problem can be solved? — 6

6. a. What is the difference between the role of a routing protocol from the role of a router itself? — 2
   b. Why administrative distance is important for path selection? Explain with example. — 4
   c. You are designing a network with subnet of variable sizes as shown below. Figure out two problems of your design for which you will not be able to communicate from one subnet to another. — 4

202.45.67.195
Subnet C 22 Users
202.45.67.192/28

202.45.67.130
Subnet A 115 Users
202.45.67.0/25

202.45.67.155
Subnet B 60 Users
202.45.67.128/26

   d. Suppose you are designing a network and after configuring each path/subnet/router/switch you are finally trying to troubleshoot. List any four commands that that can be used for this troubleshooting. — 2

7. a. Explain various types of BGP protocols with figures. — 5
   b. Let a web server runs in Host C on port 80 with persistent connections and is currently receiving requests from two different hosts A and B. — 4
      (i) Are all the requests being sent through the same socket at host C?
      (ii) If they are passed through different socket, do both of the sockets have port 80?
      Discuss both the answers.
   c. TCP servers use different socket for each connecting client. Therefore, if there are n simultaneous connections, each from a different client host, how many socket world the TCP server need? — 3

Institute of Information Technology

Jahangirnagar University

THIRD YEAR FIRST SEMESTER B.SC (HONS) FINAL EXAMINATION, 2019

[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) Consider the given continuous signal given in fig. 1. Sketch the   6
        following forms:

        i. $x(t - 2)$;
        ii. $x(2t)$;
        iii. $x(t/2)$.
        iv. $x(-t)$
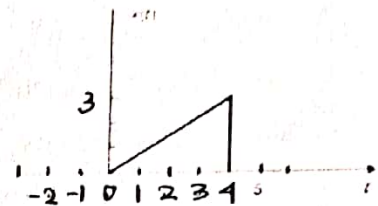
Fig. 1

   b) Consider the following signals $x_1(t) = \begin{cases} 1; & -3 < t < 3 \\ 0; & otherwise \end{cases}$ and $x_2(t) = \begin{cases} 2; & -10 < t < 10 \\ 0; & otherwise \end{cases}$.   4

        Find and sketch
        i. $Y_1(t) = x_1(t) - x_2(t)$
        ii. $Y_2(t) = x_1(t) \times x_2(t)$

   c) Consider the continuous time signal $x(t) = \begin{cases} 0; & t < 0 \\ 1.5; & 0 \le t \le 2 \\ -1; & t > 2 \end{cases}$. Find and sketch $y(t) = 3x(t)$.   2

2. a) How impulse signal, ramp signal and parabolic signal can be   4
        expressed using unit step signal? Express the signals shown in
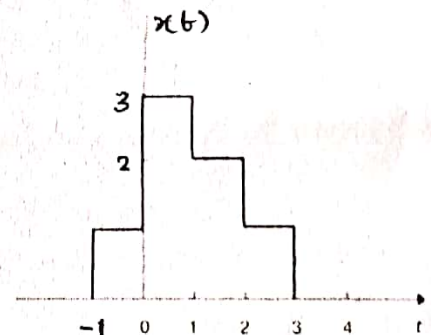   Fig. 2 in terms of unit step functions.

Fig. 2

   b) The discrete-time system shown in Fig. 3 is known as the unit delay element. Determine whether the   5
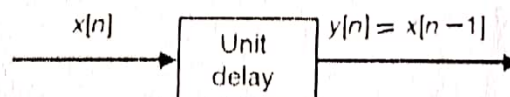   system is (i) memoryless, (ii) causal, (iii) linear, (iv) time-invariant, or (v) stable.

Fig. 3

   c) Find the even and odd components of $x(t) = e^{jt}$.   3

3. a) Define LTI system. Write the properties of LTI system.
   b) Derive the differential and difference equations of casual LTI systems
   c) Prove that $x[n] * h[n] = h[n] * x[n]$.

4. a) Prove the following properties of Fourier Transform for continuous time signals: 6
      i.   Shifting in time and frequency
      ii. Time and frequency differentiation
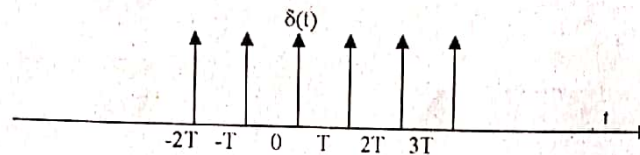   b) Determine C_n of periodic impulses shown fig. 2   3

Fig. 2

   c) Find Fourier Transform of signal, $\text{sgn}(t) = \begin{cases} 1; & t > 0 \\ -1; & t < 0 \end{cases}$ 3

5. a) Mention the properties of Laplace Transform.   3
   b) Find Laplace transform of the following signals: 6
      i. $f(t) = sin\omega_0 t . u(t)$
      ii. $f(t) = e^{-3t}u(t) + e^{2t}u(t)$
   c) Find the inverse Laplace transform of $X(s) = \frac{2s+4}{s^2+4s+3}$; $Re(s) > -1$ 3

6. a) Prove the differentiation property in time and in Z-domain.   3
   b) Find $X(z)$ and its ROC for the following sequences: 9
      i. $x[n] = \left\{5, 3, \underset{\uparrow}{-2}, 0, 4 - 3\right\}$
      ii. $x[n] = a^n u[n]$
      iii. $x[n] = na^{n-1}u[n]$

7. a) Explain the reconstruction of sampled signal. Why message reconstruction is not possible with practical low pass filter?   6
   b) A message signal m(t)=cos10πt + cos 30πt be sampled at 20 Hz and reconstruction using an ideal low-pass filter with cut off frequency 20Hz. Find the frequency or frequencies present in the reconstructed signal.   3
   c) Find the Nyquist rate for a sampled signal $sa^2(4\pi t).sa^1(3\pi t)$. A band pass signal extends from 4-6kz. What is the smallest sampling frequency to retain the signal completed   3

Institute of Information Technology
Jahangirnagar University
3rd Year 1st Semester B.Sc (Hons.) Final Examination, 2019
Subject: Operating Systems

Time: 3 Hours   Course Title: IT-3107   Full Marks: 60

Answer any **Five (05)** from the following questions. Figures at the right indicate the marks.

1	a)	How does a modern OS regain control of the CPU from a program stuck in an infinite loop?	4
	b)	What is the Interrupt Vector Table and what role does it play in protecting the kernel?	4
	c)	Assume that cache is a write-back cache. How many writes are taking place between cache and memory?	4

2	a)	What are the operating system services?	2
	b)	Draw a symmetric multiprocessing architecture.	2
	c)	What are the difference of asymmetric and symmetric multi-processing?	2
	d)	Explain the process state diagram.	4
	e)	Draw the process control block.	2

3	a)	Discuss the types of Scheduler.	2
	b)	Draw and discuss the medium term Scheduling diagram.	3
	c)	Define Context switching.	1
	d)	What is micro kernel? Draw the Android architecture.	3
	e)	What is independent and cooperative process? Write down the advantages of cooperative process.	3

4	a)	Draw the multi-threaded models.	2
	b)	Define: Named Pipes, Throughput, Socket	3
	c)	What is concurrency and Parallelism?	2
	d)	What are the approaches of thread cancellations?	2
	e)	Priority Scheduling:	3

Process arrival	Burst Time	Priority
P_1	12	3
P_2	5	1
P_3	3	4
P_4	4	5
P_5	8	2

Draw the Gant 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 are the differences between deadlock and starvation?	2
	d)	Discuss the dinning philosopher problem and its solution.	3

e) Round Robin Time Quantum=5

Process	Burst Time
P_1	22
P_2	12
P_3	10
P4	6

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 process and resources as follows: 3+1

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:

	Allocation	Max	Available
	A B C	A B C	A B C
P_0	0 1 0	7 5 3	4 4 3
P_1	2 0 0	3 2 2	
P_2	3 0 2	9 0 2	
P_3	2 1 1	2 2 2	
P_4	0 0 2	4 3 3	

Is it in safe state?

Request (2, 4, 0) by P4 and (1, 2, 2) by P0 is granted or not?

7 a) i. With a two-level page table, 16-KB pages, and 4-byte entries, how many bits   6
        should be allocated for the top-level page table field and how many for the next
        level page table field?
        ii. Consider a machine with 64 MB physical memory and a 32-bit virtual address
        space. If the page size is 4KB, what is the approximate size of the page table?

   b) i. Briefly describe first fit, best fit and worst fit memory management algorithms.   6
        ii. Which one performs better in practice (Explain)?
        iii. Consider a swapping system in which memory consists of the following hole
        sizes in memory order: 10MB, 4 MB, 20 MB, 18 MB, 7 MB, 9 MB, 12 MB, and
        15 MB (in order). Which hole is taken for successive segment requests of 12 MB,
        10MB, 9 MB (in order) for best fit and worst fit?

Institute of Information Technology
Jahangirnagar University
B.Sc. (Hons.) in Information Technology
3rd year 1st semester examination 2019

Course Code: IT-3109   Time: 3 hours
Course Title: Simulation and Modelling   Full Marks: 60

Answer any FIVE Questions

1. a) What is *simulation*? Explain the discrete and continuous systems.   2

   b) What is a model, what is the goal of a model, and why do we build models?   2

   c) Consider the following *single-server queueing* system from time = 0 to time = 10   6
   sec. Arrivals and service times are:
   - Customer #1 arrives at $t = 1$ second and requires 2 seconds of service time
   - Customer #2 arrives at $t = 2$ second and requires 2 seconds of service time
   - Customer #3 arrives at $t = 5$ seconds and requires 2 seconds of service time
   - Customer #4 arrives at $t = 8$ seconds and requires 2 seconds of service time

   Find the throughput (X), total busy time (B), mean service time (Ts), utilization (U)
   for the system.

   d) Classify simulation models in to these different dimensions.   2

2. a) When a simulation called Discrete-Event Simulation or Continuous-Event   4
   Simulation?

   b) Explain a single-server queue and its different states   4

   c) Write some advantages and disadvantages of simulation.   4

3. a) If notation t_i, A_i, S_i, D_i, C_i and e_i are used to explain a single-server queue for time   4
   of arrival of ith customer, interarrival time between $(i-1)$st and ith customers, service-
   time requirement of ith customer, delay in queue of ith customer, time ith customer
   completes service and departs and time of occurrence of the jth event respectively
   then write their relationships and draw the system in a diagram.

   b) Suppose virtual customers are arrived with the following inter-arrival time and   4
   service time
   $$A_1 = 0.4, S_1 = 2.0 \qquad A_2 = 1.6, S_2 = 0.7 \qquad A_3 = 0.4, S_3 = 0.3$$
   $$A_4 = 1.1, S_4 = 1.1 \qquad A_5 = 0.2, A_6 = 1.4, A_7 = 1.3$$

   If Q(t) is the queue length at time t and B(t) is the busy function against t. Construct
   the function queue length Q(t) and server business B(t).

   c) What is Time-Average Queue Length? Calculate it from the above example.   4

4. a) When and why a probability distribution associated with simulation? Give examples of the use of discrete and continuous probability distribution in simulation.   4

b) Explain Different Kinds of Queuing Systems along with their parameters. State and explain Little's law and utilization law in queuing system.   4

c) Write the probability function of exponential distribution with it mean and variance. Why is this distribution called memory-less distribution?   4

5. 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 process 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

6. a) Briefly explain the terms: Trace-driven simulation, Linear Congruential Generators   4

b) What is uniform test and correlation test of random number?   4

c) Write the process of inverse transform method to generate random numbers? Write the problems with the inverse transform method   4

7. a) What is Monte Carlo simulation?   4

b) Explain briefly three basic types of parameters to describe the distribution.   3

c) Explain following two distribution:
    i) Binomial distribution
    ii) Geometric distribution   2

d) Consider an M/M/1 queuing system with an arrival rate $\lambda=0.4$ and service rate $\mu=0.5$. Compute the system load and show that the system is stable or not.   3