



Institute of Information Technology  
Jahangirnagar University

3<sup>rd</sup> Year 1<sup>st</sup> Semester B.Sc (Hons.) Final Examination, 2017

Subject: Information Technology

Session: 2014-2015

Time: 3 Hours

IT3101: Database Management System

Full Marks: 60

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

1. a) Discuss the main characteristics of the database approach. How does it differ from traditional file system? 4  
b) How many types of Data Model are in DBMS? Explain each model of DBMS. 4  
c) Draw a schema diagram for the relational database schema given below. What are the appropriate primary keys? Given your choice of primary keys, identify appropriate foreign keys. 4  
Branch (branch\_name, branch\_city, assets)  
Customer (customer\_name, customer\_street, customer\_city)  
Loan (loan\_no, branch\_name, amount)  
Borrower (customer\_name, loan\_no)  
account (account\_no, branch\_name, balance)  
depositor (customer\_name, account\_no)
2. a) Given the schema 6  
EMP (Fname, Lname, SSN, Bdate, Address, Sex, Salary, SuperSSN, Dno)  
DEPT(Dname, Dnumber, MgrSSN, MGrstartdate)  
DEPT-LOC (Dnumber, Dloc)  
PROJECT(Pname, Pnumber, Ploc,Dnum)  
WORKS-ON (ESSN, PNo, Hours)  
Give the relation algebra expression for the following:  
i. List female employees from Dno=20 earning more than 50000  
ii. List 'CSE' department details.  
iii. Retrieve the first name, last name and salary of all employees who work in departmental number 50  
iv. Retrieve the name of the manager of each department.  
v. Retrieve the name and address of all employees who work for sports department.  
b) Consider a database used to record the marks that students get in different exams of different course offerings (sections). Construct an E-R diagram that models exams as entities, and uses a ternary relationship, for the database. 3  
c) Consider the relation **Course** (course\_id, title, dept\_name, credit) and **Prereq** (courses\_id, prereq\_id). 3  
Show the output of natural full outer join of these tables using some sample data.
3. a) Explain the distinctions among the terms primary key, candidate key, and superkey. 4  
b) How can a many-to-many cardinality can be changed to one-to-many/one-to-one? Explain with an example. 4  
c) Give example of the following terms for any database: 4  
i. Complex attributes  
ii. Aggregation
4. a) What are identifying and identifying relations? Explain with an example. 4  
b) What is scalar subquery? Give an example. 3  
c) Write the following SQL queries using aggregate functions for the University database given in fig. 2: 3  
i. Find the total number of **instructors** who **teach a course** in the Spring 2010 **semester**.  
ii. Find the names and average salaries (from **Instructor**) of all **departments** whose average salary is greater than 42000.  
d) What is domain of an attribute? Given an example. 2

5. a) For relations R and S shown in fig.1, show the output of natural join.

A	B	C	D
$\alpha$	1	$\alpha$	a
$\beta$	2	$\gamma$	a
$\gamma$	4	$\beta$	b
$\alpha$	1	$\gamma$	a
$\delta$	2	$\beta$	b

R

E	D	F
1	a	$\alpha$
3	a	$\beta$
1	a	$\gamma$
2	b	$\delta$
3	b	$\epsilon$

S

Fig. 1

- b) Consider the relational database of banking system mentioned in question no. 1(c). Give an expression in the relational algebra to express each of the following queries: 6
- Find the names of all employees who live in city "Narayanganj" and whose salary is greater than 50,000tk.
  - Find the names of all branches located in "Khulna".
  - Find the names of all borrowers who have a loan in branch "Gulshan1".
- c) Consider the foreign key constraint from the *dept name* attribute of *Instructor*(ID, name, dept\_name, salary) to the *department*(dept\_name, Building, Budget) relation. Give examples of inserts and deletes to these relations, which can cause a violation of the foreign key constraint. 3
6. a) For a relation such as *employee*(ID, name, street, city, salary) find the solution for lossless decomposition. Justify your answer. 4
- b) How many Functional dependencies can be found in a database? Give example of each of them. 5
- c) Write the conditions for any database to be in upto third normal form. 3
7. a) Normalize the following relation up to 3NF. Show its dependency diagram also. 7
- Student\_Instructor* (Student\_Name, Semester, Dept\_name, Instructor\_Name, Contact\_No, Project\_ID, Project\_Tilte)
- b) Explain the following term with example: 5
- Transaction
  - Referential Integrity





Institute of Information Technology  
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3<sup>rd</sup> Year 1<sup>st</sup> Semester B.Sc (Hons.) Final Examination, 2017  
**Subject:** Computer Network and Internet Technology  
**Course Code:** IT3103

Time: 3 Hours

Answer any **Five (05)** from the following questions. Figures at the right indicate the marks. Full Marks: 60

1. 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. 6  
    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?  
    iii) Why will there be a queuing delay if three users transmit at the same time?  
b. Consider sending a packet from a source host to a destination host over a fixed route. 6  
    I) Briefly describe each delay components in the end-to-end delay.  
    II) Which of these delays are constant and which are variable?
2. a. Briefly describe how many different ways a network can be attacked. 6  
b. What is the difference between network architecture and application architecture? 3  
c. For a P2P file-sharing application, do you agree with the statement, "There is no notion of client and server sides of a communication session"? Why or why not? 3
3. a. Suppose you wanted to do a transaction from a remote client to a server as fast as possible. Would you use UDP or TCP? Why? Explain your answer. 4  
b. Consider an e-commerce site that wants to keep a purchase record for each of its customers. Describe how this can be done with cookies. 4  
c. Describe how Web caching can reduce the delay in receiving a requested object. Will Web caching reduce the delay for all objects requested by a user or for only some of the objects? Why? 4
4. a. Suppose Alice, with a Web-based e-mail account (such as Gmail) sends a message to Bob, who accesses his mail from his mail server using POP3. Discuss how the message gets from Alice's host to Bob's host. 6  
    **Note:** Be sure to focus the series of application-layer protocols that are used to move the message between the two hosts.  
b. In what way is instant messaging with a centralized index a hybrid of client-server and P2P architecture? 3  
c. What is meant by handshaking protocol? Explain. 3
5. a. Briefly describe the services that a transport layer can offer applications that invoking it. 6  
b. Discuss the procedure when a browser (that is, an HTTP client), running on some user's host, requests the URL [www.juniv.edu/index.html](http://www.juniv.edu/index.html) with block diagram. 6

6. a. Describe why an application developer might choose to run an application over UDP rather than TCP? 3
- b. Suppose Host A sends Host B a TCP segment encapsulated in an IP datagram. When Host B receives the datagram, how does the network layer in Host B know it should pass the segment to the TCP rather than to UDP or to something else? 3
- c. Write down the algorithm for RIP protocol. 6
7. a. What do you mean by routing and Forwarding? 2
- b. Given IP 196.200.100.10/28 8
- Find the following things
- i) Total number of Network and Hosts
  - ii) 2<sup>nd</sup> Subnet First Valid Host IP
  - iii) 2<sup>nd</sup> Subnet Last Valid Host IP
  - iv) 2<sup>nd</sup> Subnet Broad cast address and Network Address
- c. Discuss the necessary elements that we need to build a Virtual Circuit system. 2



INSTITUTE OF INFORMATION TECHNOLOGY  
JAHANGIRNAGAR UNIVERSITY  
3rd Year 1st Semester B.Sc. (Hons.) Final Examination-2017 (Session: 2014-15)  
Subject: Information Technology  
**Course IT-3105 (Signal and System)**  
Time: 3 Hours Marks: 60

Answer any FIVE of the following questions. Numerals at the right margin indicate marks.

1. a) What is signal? Explain the classification of signals with examples. 5  
b) Find out whether the signal given by  $x(n) = 5\cos(6\pi n)$  is periodic. 2  
c) Let  $x_1(t)$  and  $x_2(t)$  be periodic signals with fundamental periods  $T_1$  and  $T_2$  respectively. Under what conditions is the sum  $x(t) = x_1(t) + x_2(t)$  periodic? 2  
d) For the systems represented by the function  $T[x(n)] = ax(n) + 6$ , determine whether the system is (i) stable (ii) causal (iii) linear (iv) shift invariant. 3
2. a) Define causal system. What is the condition for (i) causality and (ii) stability for a given system? 4  
b) A system is given by  $H(z) = (z^3 + z)/(z + 1)$ . Check whether the system is causal or not. 2  
c) Suppose  $r(t)$  is a ramp function, when will  $r(t) = 0$  and  $r(t) = t$ ? For which condition, the unit step function produce a i) zero output ii) unit output? 2  
d) Define system with examples. Draw a block diagram that describes the interaction between a system and its associated signal. 4
3. a) What are the types of Fourier series? Write down the trigonometric form of the Fourier series representation of non-periodic signal. What are the various representations of signal? Why is a signal converted from one representation to another? 3  
b) If  $x(t)$  is an integrable continuous-time signal, then write the equation of Fourier transform  $X(\omega)$  of this signal. How  $x(t)$  can be constructed from  $X(\omega)$ ? 4  
c) Briefly explain the following properties of Fourier transform: 3  
    i) Time Scaling  
    ii) Time Reversal  
d) Determine whether the system  $y(t) = x(t+10) + x^2(t)$  is static or dynamic, linear or non-linear, shift variant or invariant, causal or non-causal, stable or unstable. 2
4. a) Define Laplace transform and inverse Laplace transform. 2  
b) Find the trigonometric fourier series representation of a periodic signal  $x(t) = t$ , for the interval of  $t = -1$  to  $t = 1$ ? 3  
c) Determine the inverse Laplace of the following function:  $\frac{s^2 + 8s + 6}{(s + 2)(s^2 + 2s + 1)}$  4  
d) What do you mean by 'region of convergence' of Laplace transform? 3

5. a) Define z-transform. State the importance of z-transform on signals and systems? 4
- b) Differentiate between-
  - i) z-transform and Laplace transform
  - ii) differential equation and difference equation
- c) Using the power series expansion technique, find out the unilateral z-transform of the discrete-time signal  $x[n]=a^n$  where  $a$  is a real number. 2
- d) State some properties of a z-transform and Laplace transform. 3
6. a) What do you mean by aliasing? What are the effects of aliasing? How the aliasing process is eliminated? 3
- b) Determine the z-transform of the signal  $x(n) = (-1)^n 2^{-n} u(n)$  and plot the ROC for the sequence. 3
7. a) What do you mean by 'multiplexing' and 'de-multiplexing' techniques? Why are they used in communication system? 4
- b) List various categories of multiplexing techniques. Give the conceptual illustration of frequency-division multiplexing and demultiplexing technique. 5
- c) What are the merits and demerits of FDM over TDM? 3





Institute of Information Technology  
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3<sup>rd</sup> Year 1<sup>st</sup> Semester B.Sc (Hons.) Final Examination, 2017  
**Subject: Operating System**  
**Course Code: IT3107**

Time: 3 Hours

Full Marks: 60

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

1.
  - a. What is micro kernel? Draw the Android architecture 3
  - b. What is thread? Discuss the types of scheduler. 3
  - c. Draw the medium term scheduling diagram. 2
  - d. What is context switching? 1
  - e. Mention the steps that can terminate a process. 1
  - f. What is independent and cooperative process? Write down the advantages of cooperative process. 2
2.
  - a. Draw the multi-threaded models. 2
  - b. Define: Throughput, Waiting Time, 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 <sub>1</sub>	10	3
P <sub>2</sub>	4	1
P <sub>3</sub>	2	2
P <sub>4</sub>	6	5
P <sub>5</sub>	5	4

Draw the Gantt Chart and Find Average Waiting time.

3.
  - a. What is deadlock? 2
  - b. Mention the necessary conditions which must hold for deadlock. 2
  - c. What is dining philosopher problem? 2
  - d. Mention several ways to get rid of this problem. 1
  - e. Round Robin Time Quantum = 5 3

Process	Burst Time
P <sub>1</sub>	24
P <sub>2</sub>	10
P <sub>3</sub>	14
P <sub>4</sub>	7

Draw the Gantt chart

4.
  - a. What is safe state? Discuss the safety Algorithm. 3
  - b. Explain the necessary steps for avoiding deadlock. 2
  - c. Explain the Banker's algorithm. 3

- d. Consider a system with 5 process and resources are as follows:

3+1

5 processes  $P_0$  through  $P_4$

3 resource types:

A (10 instances), B (5 instances) and C (7 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	3	3	2
$P_1$	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			

- i) Is it in safe state?
  - ii) Request (2, 2, 0) by  $P_4$  and (0, 1, 1) by  $P_0$  is granted or not?
5. a. What was the major drawback of Peterson's solution in case of solving the critical section problem? 2
- b. What is a test-and-set instruction? How can it be used to implement mutual exclusion? Consider using a fragment of psuedo-assembly language to aid you explanation. 6
- c. What is semaphore? To solve which problem, the concept of semaphore was introduced? 4
6. a. What is paging? Write down the basic method of paging. 2
- b. What are the methods used for dynamic memory allocation? Explain. 3
- c. What is page fault? Explain the virtual memory. 3
- d. What is thrashing? How might it be detected? How it can be recovered? 4
7. a. Describe the difference between external and internal fragmentation. Indicate which of the two are most likely to be an issues on i) a simple memory management machine using base limit registers and static partitioning, and ii) a similar machine using dynamic partitioning. 4
- b. In which condition CPU scheduling decision takes place? 4
- c. The file system buffer cache does both buffering and caching. 4
  - i) Describe why buffering is needed.
  - ii) Describe how buffering can improve performance (potentially to the detriment of file system robustness).
  - iii) Describe how the caching component of the buffer cache improves performance.

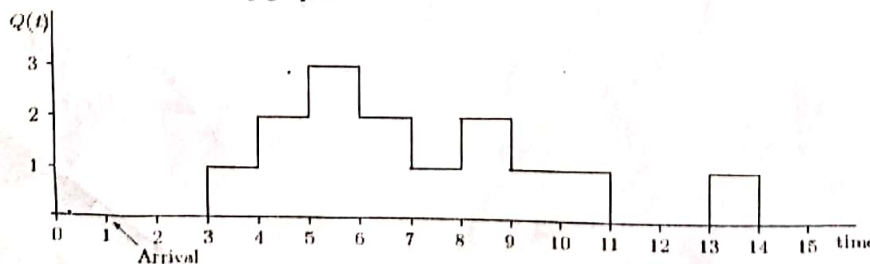




Answer any **Five (05)** from the following questions. Figures at the right indicate the marks.

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 sec. Arrivals and service times are: 6
  - 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 ( $T_s$ ), utilization (U) for the system.  
 d) Classify simulation models in to these different dimensions. 2
2. a) What is the use of probability distribution in system simulation? Give an example of discrete distribution and continuous distribution? 4  
 b) State the steady parameters of M/M/1. What would change if service time is not Markovian. 3  
 c) Arrivals at a bank teller's cage are Poisson at the rate of 1.2 in a minute. Find the probability of (i) no arrival in the next 1 minute and (ii) 2 to 3 arrivals in next 2 minutes. 5
3. a) List two advantages of simulation models as compared to analytical models. 2  
 b) Consider an unfair six-sided die where the probability of rolling a "1" is three times the probability of rolling any other value. All other values have the same probability of occurring. Let X be the random variable that takes on values 1 through 6 for our unfair die. Plot the PMF and CDF of X. Determine the mean of X. 4  
 c) Describe any two common distributions and examples of their use. 4  
 d) What is the unique property of the exponential distribution? 2
4. a) For an M/M/1 queue we know that the mean number of customers in the system (L) is equal to the utilization divided by one minus the utilization. Using basic laws and relationships, derive the mean wait in the system (W), the mean number of customers in the queueing area (Lq), and the mean wait in the queueing area (Wq) as a function of arrival rate and service rate. 5  
 b) Perform runs test on the following sequence of numbers: 4  
 0.08, 0.09, 0.43, 0.29, 0.42, 0.53, 0.68, 0.10, 0.76, 0.98  
 c) What are the three measures of the system performance in a single server queueing system? 3
5. a) Explain the Little's Law for a queueing system. Prove the following relation: 3  

$$N = \rho / (1 - \rho)$$
 where N = mean number of the system, and  $\rho$  = utilization factor.  
 b) Prove that "The system is unstable system if  $\rho > 1$ " where  $\rho$  utilization factor. 3  
 c) Consider the following graph. 6



In the above single-server queueing system, find

- i) Average delay in queue.
- ii) Average number of customers in the queue.

6. a) What is Monte Carlo simulation? 2  
 b) Explain briefly three basic types of parameters to describe the distribution. 3  
 c) Explain following two distribution: 4  
     i) Binomial distribution  
     ii) Geometric distribution  
 d) Consider an M/M/1 queueing 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
7. a) Briefly describe the following concepts: 4  
     i) Trace-driven simulation  
     ii) Empirical distributions  
 b) Describe the linear congruential method for random number generation. Use the multiplicative congruential method to generate a sequence of four random integers (3 digit length), with seed = 117, constant multiplier = 43 and modulus = 1000. 3  
 c) How do you estimate distribution parameters using Maximum Likelihood Estimator (MLE)? 2  
 d) What is regression analysis? How do you find the dependency of a random variable by drawing scatter diagram? 3