

SECTION A

PART I - Multiple Choice Questions (30 Marks)

Choose the correct answer and write down the letter of the correct answer chosen in the Answer Booklet against the question number. E.g. 31 (c). Each question carries ONE mark. Any double writing, smudgy answers or writing more than one choice shall not be evaluated.

1. All of the following are TRUE about the First Come First Served Scheduling (FCFS) EXCEPT:

- A. process that request the CPU first is allocated CPU first
- B. average waiting time is generally long
- C. priority can be defined internally or externally
- D. managed by FIFO queue

2. Which of the following is correct about the Real Time Operating Systems?

- A. multitasking
- B. resource sharing
- C. resource driven
- D. computation speed up

3. Which technique was introduced because a single job could not keep both the CPU and I/O devices busy?

- A. multitasking
- B. multiprogramming
- C. multiprocessing
- D. multithreading

4. The minimum expression of $AB'D+ABD'+B'D'$ is :

- A. $B.D+AD'+A'B'$
- B. $B'D+AD+AB'$
- C. $B'D'+AD'+AB'$
- D. $B'D'+AD'+A'B'$

5. What will be the output of the following C code?

```
#include<studio.h>
Void main ()
{
    int arr [ ] [3]={ {1,2}, {3,4,5},{5} };
    printf(“%d %d %d”, sizeof (arr), arr [0] [2], arr [1] [2]);
}
```

- A. 6 0 4
- B. 18 0 5
- C. 6 1 5
- D. 18 1 5

6. The equivalent postfix expression of the following expression is:

$$(A-B) / ((D+E) * F)$$

- A. AB-DE+F*/
- B. AB+D+F*/
- C. AB+DE+F*/
- D. AB-DE-F*/

7. Recursive procedures are implemented by which of the following data structures?

- A. queues
- B. strings
- C. linked lists
- D. stacks

8. Digital signaling, bidirectional, bus topologies are the characteristics of which type of transmission technique that are used in coaxial cable?

- A. split broadband
- B. dual cable broadband
- C. baseband
- D. broadband

9. Convert the IP address whose hexadecimal representation is C0A8000D:

- A. 192.168.0.13
- B. 192.168.0.14
- C. 192.168.0.15
- D. 192.168.0.16

10. Convert 1011011011110001 to Hexadecimal:

- A. BF61
- B. B6F1
- C. B66F
- D. BB6F

11. Which layer of the TCP/IP model processes requests from hosts to make sure a connection is made to the appropriate port?

- A. Application layer
- B. Physical layer
- C. Transport layer
- D. Presentation layer

12. Which transport layer protocol is used for real-time multimedia transmission?

- A. TCP
- B. UDP
- C. TCP/IP
- D. ICMP

13. Modem stands for:

- A. Modulator De Multiplexer
- B. Modulator De Modulator
- C. Multiplexer De Modulator
- D. Multiplexer De Multiplexer

14. The three schema architecture of DBMS is:

- A. internal, conceptual and external schema
- B. single, end or multiple schema
- C. relational, network or hierarchical schema
- D. presentation, business and data schema

15. Most of the time, modification anomalies are serious enough that tables should be normalized into?

- A. NF
- B. 2NF
- C. 3NF
- D. BCNF

16. Which of the following is a Data Manipulation Language (DML) command?

- A. INSERT
- B. CREATE
- C. UPDATE
- D. TRUNCATE

17. Which keyword is used to inherit class?

- A. extend
- B. extends
- C. inherit
- D. inherits

18. When a program does not want to handle exception, the -----class is used.

- A. RuntimeException
- B. Java.throws
- C. Throws
- D. Catch

19. Which of the following is true about the structured design?

- A. function are mapped to a model structure
- B. it transforms the textual description of a problem into a graphic model
- C. functional decomposition of the system takes place
- D. capture the detailed structure of the system as perceived by the user

20. The most time consuming phase of system development life cycle is:

- A. requirement gathering and analysis
- B. implementation
- C. design
- D. deployment

21. The type of testing that does not execute the code is called:

- A. dynamic testing
- B. referential testing
- C. manual testing
- D. static testing

22. A technique used in testing modules, especially where modules are written and tested in a top-down fashion, where few lines of code are used to substitute for subordinate modules describes:

- A. top down testing
- B. black box testing
- C. module testing
- D. stub testing

23. Light bends as it enters a different medium –this process is known as:

- A. reflection
- B. refraction
- C. diffraction
- D. interference

24. Intensity of sound at a point is _____ its distance from the source.

- A. directly proportional to
- B. directly proportional to square of
- C. inversely proportional to square of
- D. inversely proportional to

25. The circuit used to store one bit of data is known as:

- A. flip flop
- B. encoder
- C. decoder
- D. series circuit

26. The cache memory of 1K words uses direct mapping with a block size of 4 words. How many blocks can the cache accommodate?

- A. 1024 words
- B. 128 words
- C. 256 words
- D. 512 words

27. Block or buffer caches are used to:

- A. speed up main memory read operations
- B. increase the capacity of main memory
- C. improve disk performance
- D. handle interrupts

28. The maximum number of points that can be displayed without overlap on a CRT is referred to as:

- A. refraction
- B. resolution
- C. refractive index
- D. index of refraction

29. What the difference between XML and HTML?

- A. HTML is used for exchanging data, XML is not
- B. XML is used for exchanging data, HTML is not.
- C. HTML can have user defined tags, XML cannot.
- D. All of the above

30. Find the equation of the line which goes through the point (1,2) and is parallel to the line through the points (0,1) and (-2,7).

- A. $y = 3x+5$
- B. $y = -3x-5$
- C. $y = -3x+5$
- D. $y = 3x-5$

PART – II : Short Answer Questions (20 marks)

Answer ALL the questions. Each question carries 5 marks. Mark for each sub-question is indicated in the brackets.

1. In Java, what does the **final** keyword mean in front of: (3 marks)
- i. a variable
 - ii. a method
 - iii. a class

Give any two differences between an *applet* and an application. (2 marks)

2. For the following table name EMPLOYEE, write a SQL query to get the desired results.

employee_id	last_name	salary	department_id
123	Dorji	13,000	4
124	Lhamo	12,250	23
125	Choden	17,000	34
126	Lhamo	12,670	22

- i. Display the employee ID, last name, salary and salary increased by 15.5% (expressed as whole number) for each employee. Label the column as New Salary. Also write another SQL query to get the maximum salary. (2 marks)
- ii. Create a query to display unique last name from the EMPLOYEE table. (1 mark)

- iii. Display the last name and department ID of all employees in department 23 and 22 in alphabetical order. (1 mark)
Write another SQL query to delete the employee whose department_id is less than 27 and greater than 20. (1 mark)

3. Briefly explain the concept of *linear* and *binary* search. (2 marks)

Specify what type of search will be used to search:

- i. Sorted array (1/2 mark)
ii. and unsorted array (1/2 mark)

For the *linear* search, if there are n elements in the array, what is the time complexity for the best, worst and average case? Also write down the time complexity for the *binary* search for n elements. (2 marks)

4. What is the size of IP and MAC address in bits? Which protocol uses CSMA/CD.? What is the purpose of ARP? (3 marks)

State the class of address (A, B or C) for the following IP address:

- i. 46.39.42.05 (1 mark)
ii. 128.64.32.16 (1 mark)

SECTION B

Case Study

Choose either Case 1 or Case 2 from this Section. Each Case carries 50 marks. Mark for each sub-question is indicated in the brackets.

CASE 1

Passenger Reservation System

Assume that ABC Bus Company has approached you for computerizing their bus reservation system for various destinations originating from Thimphu. The Company has currently about 50 buses spread over 15 routes operating from Thimphu to various places. Of them, 25 are standard, 15 are semi-luxury, and remaining are super deluxe buses. The seating capacities are 40, 30 and 20, respectively.

The Company would like to have at least one week advance reservation. The details required to be provided by the passenger would be date of journey, starting point, destination, number of seats (half or full), concession required, if any, route no., and departure time of the service. If seats are available, your system should be able to provide enquiry services in a variety of ways to help the passenger take a decision. The following are some of the questions that could be asked by the customer:

- What are the route numbers? Which buses halt at the place requested by the passenger either as a final destination or as an intermediate point?
- Whether seats are available by same route no. but at a different departure time.
- Whether seats are available by a different route no. on the same day.
- The earliest date on which seats are available for a place by a given route no.
- The cost of travel by various categories of buses (namely, standard, deluxe, etc) to a destination by various routes.

Two seats are reserved for VIPs and/or emergency quota. However, if nobody turns up for the same, up to half an hour before the departure, the seats are allotted to those in the waiting list according to priority. Concessions are given in respect of students during winter vacation. Thus they need to pay only 50% of the actual fare. Employees of ABC Company and their eligible family members may travel free once a year, by producing the appropriate identity cards. Your system must verify that the total distance travelled by such a person does not exceed 3000 km. Seats are not allowed for half ticket but a seat may be allotted for half tickets issued.

You system should provide a facility for cancellation. 10% of the fare shall be forfeited if the cancellation is done at least two days prior to the journey. 20% shall be forfeited if the cancellation is done one day prior to the journey but not more than two days, 25% if cancelled 8 hours before and 40% for less than half an hour and up to half an hour after departure of the bus. In all other cases the full amount is forfeited. The reservation fee of Nu. 5 is always non-refundable. Journey

can be postponed or advanced subject to availability of seats by the same route at most once at no extra cost.

Your system would have to maintain a database of various routes originating from Thimphu and the fare by each of them for various categories of buses to various destinations. Frequently the Corporation revises the fares and your system should accommodate this. Assume that more than one counter is simultaneously active for reservation/cancellation.

Required:

- a. Create a Level 1 Logical Data Flow Diagram for the above reservation system. (10 marks)
- b. Describe how the logic modeling may be conducted for a process that handles cancellation of reservation. (5 marks)
- c. Create an Entity Relationship Diagram (ERD) for Bus Reservation System listing the attributes for the entities. (10 marks)
- d. Design database tables and populate with likely records. (10 marks)
- e. Design a user interface form that maybe used by employees or their eligible family members to make a reservation. (5 marks)
- f. Identify some reports that maybe required from the system and write sample SQL queries that maybe deployed for one of the reports you have identified. (10 marks)

CASE 2

Use cases for Fitness First Health Club.

Create a set of use cases for the Fitness First Health Club membership system which is described in this case. When members join the health club, they pay a fee for a certain length of time. Most memberships are for one year, but memberships as short as two months are available. Throughout the year, the health club offers a variety of discounts on its regular membership prices (e.g. two memberships for the price of one for Valentine’s Day).

It is common for members to pay different amounts for the same length of membership. The club wants to mail out reminder letters to members asking them to renew their memberships one month before their memberships expire. Some members have become angry when asked to renew at a much higher rate than their original membership contract, so that the club wants to track the price paid so that the manager can override the regular prices with special prices when members are asked to renew. The system must track these new prices so that the renewals can be processed accurately.

One of the problems in the health club industry is the high turnover rate of members. While some members remain active for many years, about half of the members do not renew their memberships. This is a major problem because the health club spends a lot in advertising to attract each new member. The manager wants the system to track each time a member comes into the club. The system will then identify the heavy users and generate a report so that the manager can ask them to renew their memberships early, perhaps offering them a reduced rate for early renewal. Likewise the system should identify members who have not visited the club in more than a month so that the manager can call them and attempt to regenerate their interest in the club.

Required:

- a. Identify the major use cases for the health club system described above by reporting on the name, description, trigger and easily identified major inputs and outputs. (15 marks)
- b. Identify the major steps within each use case by describing the major steps needed to process the inputs and produce the outputs. (15 marks)
- c. Identify the elements within each step by asking how manager knows when to do what in each step. What forms/reports/data are needed or produced in each step and what happens in the absence of these forms/reports/data? (15 marks)
- d. Generate at least one complete sample Use Case that can be used for confirmation. (5 marks)