GU-RET 2016

GAUHATI UNIVERSITY RESEARCH ELIGIBILITY TEST

INFORMATION TECHNOLOGY

Booklet Series : **B**

Invigilator's Name and Signature

BOOKLET NO.

OMR SHEET NO.

ROLL NO.

TIME : 2 HOURS 20 MINUTES

TOTAL MARKS : 80

Number of Pages in this Booklet : **20**

Instructions for Candidates

1. Write your Roll No. and OMR Sheet No. in the boxes provided above.

2. This paper consists of two sections : **Section B** with 50 (fifty) multiple choice questions (MCQ) and **Section C** with 7 (seven) descriptive questions. Each MCQ has 4 (four) answers, out of which ONLY one is correct. You have to darken the circle (on the OMR Sheet) for the correct answer corresponding to the question given in this booklet.

   Example : Ⓐ Ⓑ Ⓒ Ⓓ

   where Ⓒ is the correct answer. No marks will be given for markings made in this booklet. The descriptive questions in **Section C**, MUST be answered in the space provided in this booklet. **No extra pages will be provided in any case.**

3. Use a BLACK ball point pen in your OMR Sheet.

4. Read the instructions given inside this booklet before attempting to answer any questions.

5. DO NOT write your name, roll no, phone no, or anything, or put any marks anywhere in this booklet, otherwise your candidature will be disqualified.

6. If you are found to resort to any kind of unfair means such as carrying extra material other than pen, pencil, watch, eraser, and scale, or copying from somebody or from external material, your candidature will be disqualified.

7. Use of mobile phones, calculators, log tables or any other tables, wearable smart devices such as smart Android watches or objects of similar nature CAN NOT be used inside the examination hall.

8. At the end of the examination, you have to return this booklet and the OMR Sheet back to the invigilator.

9. There is no negative marks for incorrect answer.

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Section B (50 Marks)

1. The goal of structured programming is to

   (A) have well indented programs
   (B) be able to infer the flow of control from the compiled code
   (C) be able to infer the flow of control from the program text
   (D) avoid the use of GOTO statements

2. An abstract data type is

   (A) same as an abstract class
   (B) a data type that cannot be instantiated
   (C) a data type for which only the operations defined on it can be used, but none else
   (D) All of the above

3. A common property of logic programming languages and functional languages is

   (A) both are procedural languages
   (B) both are based on l-calculus
   (C) both are declarative
   (D) both use Horn-clauses

4. The period of time between an allocation and it's subsequent disposal is called

   (A) scope
   (B) lifetime
   (C) longevity
   (D) None of the above

5. In datagram subnet, new route is chosen ......

   (A) for every packet sent
   (B) for all the packet sent
   (C) only for the first packet
   (D) for the packet which is not transmitted

6. To do multicast routing, each router computes a ......

   (A) Binary tree
   (B) AVL tree
   (C) Spanning tree
   (D) None of these

7. The subnet mask for a particular network is 255.255.31.0. Which of the following pairs of IP addresses could belong to this network?

   (A) 172.57.88.62 and 172.56.87.23
   (B) 10.35.28.2 and 10.35.29.4
   (C) 191.203.31.87 and 192.234.31.88
   (D) 128.8.129.43 and 128.8.161.55

8. Protocols in which stations listen for a carrier and act accordingly are ......

   (A) ALOHA
   (B) Multiple access
   (C) Station Model
   (D) CSMA

9. What is the type of network in which the topology changes from time to time?

   (A) Wi-Fi
   (B) Cell Network
   (C) MANET
   (D) LAN

10. Header of a frame generally contains

   (A) synchronization bytes
   (B) addresses
   (C) frame identifier
   (D) All of the mentioned

11. Resources are allocated to the process on non-sharable basis is

   (A) Mutual exclusion
   (B) Hold and wait
   (C) No pre-emption
   (D) Circular wait

12. Which scheduling policy is most suitable for time-shared operating systems?

   (A) Shortest Job First
   (B) Round Robin
   (C) First Come First Server
   (D) Elevator

13. A uni-processor computer system only has two processes, both of which alternate 10 ms CPU bursts with 90 ms I/O bursts. Both the processes were created at nearly the same time. The I/O of both processes can proceed in parallel. Which of the following scheduling strategies will result in the least CPU utilization (over a long period of time) for this system?

   (A) First come first served scheduling
   (B) Shortest remaining time first scheduling
   (C) Static priority scheduling with different priorities for the two processes
   (D) Round robin scheduling with a time quantum of 5 ms

14. Run time mapping from virtual to physical address is done by

   (A) memory management unit
   (B) CPU
   (C) PCI
   (D) None of these

15. The following program:

```
main()
{
    if(fork() > 0) sleep(100);
}
```

   results in the creation of

   (A) an orphan process
   (B) a zombie process
   (C) a process that executes forever
   (D) None of these

16. A single array A[1...MAXSIZE] is used to implement two stacks. The two stacks grow from the opposite ends of the array. Variable Top1 and Top2 (Top1<Top2) point to the location of the topmost element in each of the stacks. If the space is to be used efficiently, the condition for 'stack full' is

   (A) (Top1 = MAXSIZE/2) and (Top2 = MAXSIZE/2 + 1)
   (B) Top1 + Top2 = MAXSIZE
   (C) (Top1 = MAXSIZE/2) and (Top2 = MAXSIZE)
   (D) Top1 = Top2 - 1

17. If every non-key attribute is functionally dependent on the primary key, then the relation is in

   (A) First Normal Form
   (B) Second Normal From
   (C) Third Normal Form
   (D) Fourth Normal Form

18. Consider the following set of functional dependency on the schema (A, B, C)

   $$A \to BC, B \to C, A \to B \text{ and } AB \to C$$

   The canonical cover for the set is

   (A) $A \to BC$ and $B \to C$
   (B) $A \to BC$ and $AB \to C$
   (C) $A \to BC$ and $A \to B$
   (D) $A \to B$ and $B \to C$

19. Consider the following schedules involving two transactions. Which one of the following statements is TRUE

   $$S_1 : r_1(X); r_1(Y); r_2(X); r_2(Y); w_2(Y); w_1(X)$$
   $$S_2 : r_1(X); r_2(X); r_2(Y); w_2(Y); r_1(Y); w_1(X)$$

   (A) Both S_1 and S_2 are conflict serializable
   (B) S_1 is conflict serializable and S_2 is not conflict serializable
   (C) S_1 is not conflict serializable and S_2 is conflict serializable
   (D) Both S_1 and S_2 are not conflict serializable

20. Consider the following entries in a Cascading Style Sheet (CSS) file

```
P {colour:  blue; background-colour:
   white; border-colour:  red;
   border-left:  solid}
BODY {colour:  black; border-colour:
   green}
```

   What is the colour of text in a paragraph of an HTML document that uses the above style sheet?

   (A) green
   (B) blue
   (C) black
   (D) red

21. Which of the following statements are TRUE about an SQL query?

   P: An SQL query can contain a HAVING clause even if it does not a GROUP BY clause

   Q: An SQL query can contain a HAVING clause only if it has a GROUP BY clause

   R: All attributes used in the GROUP BY clause must appear in the SELECT clause

   S: Not all attributes used in the GROUP BY clause need to appear in the SELECT clause

   (A) P and R
   (B) P and S
   (C) Q and R
   (D) Q and S

22. Which of the following is TRUE?

   (A) Every relation in 2NF is also in BCNF
   (B) A relation R is in 3NF if every non-prime attribute of R is fully functionally dependent on every key of R
   (C) Every relation in BCNF is also in 3NF
   (D) No relation can be in both BCNF and 3NF

23. `Empdt1(empcode, name, street, city, state,pincode)`. For any pincode, there is only one city and state. Also, for given street, city and state, there is just one pincode. In normalization terms, `empdt1` is a relation in

   (A) 1 NF only
   (B) 2 NF and hence also in 1 NF
   (C) 3 NF and hence also in 2 NF and 1 NF
   (D) BCNF and hence also in 3 NF, 2 NF and 1 NF

24. Which of the following statements is false about event handlers in JavaScript?

   (A) They can be included with input tags
   (B) They can be associated with end of file processing for a database application
   (C) They can be included with the form tag
   (D) They are generally used to call functions when triggered

25. The elements `<DIV>` and `<SPAN>` have the following characteristics

   (A) Element `<DIV>` inherits properties defined for `<DIV>` in a stylesheet
   (B) `<DIV>` and `<DIV>` have no real meanings as html tags unless stylesheet is applied
   (C) Elements `<DIV>` and `<DIV>` define content to be inline or block-level
   (D) `<DIV>` and `<DIV>` are used as alternatives for the element `<P>`

26. Which of the following statements is false regarding 'Cookies'?

   (A) Cookies are programs which run in the background of the web-client
   (B) Cookies have the potential of being used to violate the privacy of users
   (C) Cookies are very helpful in keeping track of users in developing online shopping cart applications, personalized portals and in advertising on web sites
   (D) Cookies usually contain data in the form of name = value pairs

27. Consider the following code

```
for i=1 to n-1
  for j=i+1 to n
    if(A[i] > A[j])
      exchange A[i] and A[j]
```

   How many times the comparison `A[i] > A[j]` executed?

   (A) n
   (B) $n(n-1)/2$
   (C) $(n(n-1)/2)+1$
   (D) $n^2 2$

28. Which of the following statements is true regarding HTTP?

   (A) Web browsers use only HTTP as a communication protocol with servers
   (B) It does not maintain any connection information on previous transactions
   (C) It is designed to route information based on content
   (D) It refers to resources using their Universal Resource Identifier (URI)

29. Which of the following is true about XHTML?

   (A) It is a new hybrid technology that is different from both XML and HTML

   (B) It has totally replaced HTML as the tool for building Web pages

   (C) It is a reformulation of HTML in XML

   (D) One cannot use it to create Web pages

30. A fair dice is tossed two times. The probability that the second toss results in a value that is higher than the first toss is

   (A) 2/36

   (B) 2/6

   (C) 5/12

   (D) 1/2

31. A source alphabet consists of N (even) symbols with the probability of all symbols being the same. A source encoder increases the probability of the first half symbol by a small amount e and decrease for other half by a small amount e. After encoding, the entropy of system

   (A) Increases

   (B) Increases if $N = 2$

   (C) Remains same

   (D) Decreases

32. A source generates three symbols with probabilities $0.25, 0.25, 0.50$ at a rate of 3000 symbols per second. Assuming independent generation of symbols, the most efficient source encoder would have average bit rate as

   (A) 6000 bits/sec

   (B) 4500 bits/sec

   (C) 3000 bits/sec

   (D) 1500 bits/sec

33. Consider the following equations of Mutual Information, Conditional Entropy and Joint Entropy. Which one of the following is not correct?

   (A) $I(X;Y) = H(X) - H(X/Y)$

   (B) $I(X;Y) = H(Y) - H(Y/X)$

   (C) $I(X;Y) = H(X) - H(Y/X)$

   (D) $I(X;Y) = H(X) + H(Y) - H(X,Y)$

34. An algorithm is made up of two independent time complexities $f(n)$ and $g(n)$. Then the complexities of the algorithm is in the order of

   (A) $f(n) \times g(n)$

   (B) $\max(f(n), g(n))$

   (C) $\min(f(n), g(n))$

   (D) $f(n) + g(n)$

35. Two alternative packages A and B are available for processing a database having 10^k records. Package A requires $0.0001n^2$ time units and package B requires $10 n \log_{10} n$ time units to process n records. What is the smallest value of k for which package B will be preferred over A?

   (A) 12

   (B) 10

   (C) 6

   (D) 5

36. The maximum numbers of nodes in a binary tree of height h is

   (A) 2^h

   (B) $2^{h-1} + 1$

   (C) $2^{h+1} - 1$

   (D) 2^{h+1}

37. Consider the following three claims

   (a) $(n + k)^m = \theta(n^m)$
   (b) $2^{n+1} = O(2^n)$
   (c) $2^{2n+1} = O(2^n)$

   Which of these claims are correct?

   (A) (a) and (b)

   (B) (a) and (c)

   (C) (b) and (c)

   (D) (a), (b), and (c)

38. A computer's memory is composed of 8K words of 32 bits each, a byte is 8 bits. How many bytes does this memory contain?

   (A) 8K

   (B) 32K

   (C) 16K

   (D) 4K

39. The first two bytes of a $2M \times 16$ main memory have the following hex values

    Byte 0 is FE
    Byte 1 is 01

    If these bytes hold a 16-bit two's complement integer, what is its actual decimal value if memory is big-endian?

    (A) 510
    (B) -511
    (C) 65025
    (D) None of these

40. Two's complement 4 bit representation of (-3) is 1101. What is be the 8 bit representation of (-3)?

    (A) 00001101
    (B) 11111101
    (C) 00000011
    (D) None of these

41. A hard disk has 63 sectors per track, 10 platters each with 2 recording surfaces and 1000 cylinders. The address of a sector is given as a triple (c, h, s), where c is the cylinder number, h is the surface number and s is the sector number. Thus, the 0th sector is addressed as $(0, 0, 0)$, the 1st sector as $(0, 0, 1)$, and so on. What is the sector number that the address <400, 16, 29> corresponds to?

    (A) 505035
    (B) 505036
    (C) 505037
    (D) 505038

42. The purpose of declaring a structure in C/C++ is

    (A) to specify a list of structure elements
    (B) to define a new data type
    (C) to set aside the appropriate amount of memory
    (D) All of the above

43. In C/C++ , enumeration is

    (A) a set of numbers
    (B) a list of strings
    (C) a list of legal values possible for a variable
    (D) a list of operators

44. In C/C++, if a static array is not initialized, then the elements will be set to

    (A) an undetermined value
    (B) zero
    (C) the character constant '0'
    (D) None of the above

45. Which one of the following are essential features of an object-oriented programming language?

    1. Abstraction and encapsulation
    2. Strictly-typedness
    3. Type-safe property coupled with sub-type rule
    4. Polymorphism in the presence of inheritance

    (A) 1 and 2 only
    (B) 1 and 4 only
    (C) 1, 2 and 4 only
    (D) 1, 3 and 4 only

46. Runtime polymorphism is achieved by

    (A) Friend function
    (B) Virtual function
    (C) Operator Overloading
    (D) Function Overloading

47. Which of the statements is / are true ?

    1. Function overloading is done at compile time
    2. Protected members are accessible to the member of derived class
    3. A derived class inherits constructors and destructors
    4. A friend function can be called like a normal function
    5. Nested class is a derived class

    (A) 1, 2, 3
    (B) 2, 3, 4
    (C) 1, 2, 4
    (D) 3, 4, 5

48. Assume that we have constructor functions for both base class and derived class. Now consider the declaration in `main()`.

    `Base * P = New Derived;`

    In what sequence will the constructor be called?

    (A) Derived class constructor followed by Base class constructor

    (B) Base class constructor followed by derived class constructor

    (C) Base class constructor will not be called

    (D) Only Derived class constructor will be called

49. Encapsulation is

    (A) Dynamic binding

    (B) A mechanism to associate the code and data

    (C) Data abstraction

    (D) Creating new class

50. When a subclass is inherited from more than one superclasses (or base classes), it is known as

    (A) Single inheritance

    (B) Hierarchical inheritance

    (C) Multiple inheritance

    (D) Multilevel inheritance

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Section C (30 Marks)

Answer any 5 (five) from the following

1. What is is Iterative Enhancement Model with reference to Software Engineering? Which development model would you follow for the following projects? Give justifications. (Marks : 6)

   (A) A simple data processing project.

   (B) A new missile tracking system. It is not known if current hardware or software technology is mature enough to achieve its goal.

2. Differentiate between lexical analysis and syntax analysis? Why they need to interact? (Marks : $3 + 3 = 6$)

3. What is combinational explosion in regards to searching? What are the complexities of Depth-First and Breadth-First techniques? (Marks : $3 + 3 = 6$)

4. What is the role of Routing Table in Internet Communication? How handoff is achieved? (Marks : $3 + 3 = 6$)

5. What are good programming practices? How they could effect in the performance of the program in runtime? (Marks : $3 + 3 = 6$)

6. What do you mean by semantics of natural language sentence? How this differs from pragmatics? With example, explain the role of semantics in NLP, over and above the syntactic structure. ($1^1/2 + 1^1/2 + 3 = 6$)

7. How transactions are possible in distributed database? What is concurrency control? (Marks : $4 + 2 = 6$)