

PAPER-III
COMPUTER SCIENCE AND APPLICATIONS

Signature and Name of Invigilator

1. (Signature) _____

(Name) _____

2. (Signature) _____

(Name) _____

J 8 7 1 4

Time : 2 ½ hours]

[Maximum Marks : 150

Number of Pages in this Booklet : 12

Number of Questions in this Booklet : 75

Instructions for the Candidates

1. Write your roll number in the space provided on the top of this page.
2. This paper consists of seventy five multiple-choice type of questions.
3. At the commencement of examination, the question booklet will be given to you. In the first 5 minutes, you are requested to open the booklet and compulsorily examine it as below :
 - (i) To have access to the Question Booklet, tear off the paper seal on the edge of this cover page. Do not accept a booklet without sticker-seal and do not accept an open booklet.
 - (ii) **Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to pages/questions missing or duplicate or not in serial order or any other discrepancy should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given.**
 - (iii) After this verification is over, the OMR Sheet Number should be entered on this Test Booklet.
4. Each item has four alternative responses marked (A), (B), (C) and (D). You have to darken the circle as indicated below on the correct response against each item.
Example : (A) (B) (C) (D)
where (C) is the correct response.
5. Your responses to the items are to be indicated in the **OMR Sheet given inside the Booklet only**. If you mark at any place other than in the circle in the OMR Sheet, it will not be evaluated.
6. Read instructions given inside carefully.
7. Rough Work is to be done in the end of this booklet.
8. If you write your Name, Roll Number, Phone Number or put any mark on any part of the OMR Sheet, except for the space allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means such as change of response by scratching or using white fluid, you will render yourself liable to disqualification.
9. You have to return the test question booklet and Original OMR Sheet to the invigilators at the end of the examination compulsorily and must not carry it with you outside the Examination Hall. You are, however, allowed to carry original question booklet and duplicate copy of OMR Sheet on conclusion of examination.
10. Use only Blue/Black Ball point pen.
11. Use of any calculator or log table etc., is prohibited.
12. There is no negative marks for incorrect answers.

OMR Sheet No. :

(To be filled by the Candidate)

Roll No.

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(In figures as per admission card)

Roll No. _____

(In words)

परीक्षार्थियों के लिए निर्देश

1. इस पृष्ठ के ऊपर नियत स्थान पर अपना रोल नम्बर लिखिए ।
2. इस प्रश्न-पत्र में पचहत्तर बहुविकल्पीय प्रश्न हैं ।
3. परीक्षा प्रारम्भ होने पर, प्रश्न-पुस्तिका आपको दे दी जायेगी । पहले पाँच मिनट आपको प्रश्न-पुस्तिका खोलने तथा उसकी निम्नलिखित जाँच के लिए दिये जायेंगे, जिसकी जाँच आपको अवश्य करनी है :
 - (i) प्रश्न-पुस्तिका खोलने के लिए उसके कवर पेज पर लगी कागज की सील को फाड़ लें । खुली हुई या बिना स्टीकर-सील की पुस्तिका स्वीकार न करें ।
 - (ii) कवर पृष्ठ पर छपे निर्देशानुसार प्रश्न-पुस्तिका के पृष्ठ तथा प्रश्नों की संख्या को अच्छी तरह चेक कर लें कि ये पूरे हैं । दोषपूर्ण पुस्तिका जिनमें पृष्ठ/प्रश्न कम हों या दुबारा आ गये हों या सीरियल में न हों अर्थात् किसी भी प्रकार की त्रुटिपूर्ण पुस्तिका स्वीकार न करें तथा उसी समय उसे लौटाकर उसके स्थान पर दूसरी सही प्रश्न-पुस्तिका ले लें । इसके लिए आपको पाँच मिनट दिये जायेंगे । उसके बाद न तो आपकी प्रश्न-पुस्तिका वापस ली जायेगी और न ही आपको अतिरिक्त समय दिया जायेगा ।
 - (iii) इस जाँच के बाद OMR पत्रक की क्रम संख्या इस प्रश्न-पुस्तिका पर अंकित कर दें ।
4. प्रत्येक प्रश्न के लिए चार उत्तर विकल्प (A), (B), (C) तथा (D) दिये गये हैं । आपको सही उत्तर के वृत्त को पेन से भरकर काला करना है जैसा कि नीचे दिखाया गया है ।
उदाहरण : (A) (B) (C) (D)
जबकि (C) सही उत्तर है ।
5. प्रश्नों के उत्तर केवल प्रश्न पुस्तिका के अन्दर दिये गये OMR पत्रक पर ही अंकित करने हैं । यदि आप OMR पत्रक पर दिये गये वृत्त के अलावा किसी अन्य स्थान पर उत्तर चिह्नानंकित करते हैं, तो उसका मूल्यांकन नहीं होगा ।
6. अन्दर दिये गये निर्देशों को ध्यानपूर्वक पढ़ें ।
7. कच्चा काम (Rough Work) इस पुस्तिका के अन्तिम पृष्ठ पर करें ।
8. यदि आप OMR पत्रक पर नियत स्थान के अलावा अपना नाम, रोल नम्बर, फोन नम्बर या कोई भी ऐसा चिह्न जिससे आपकी पहचान हो सके, अंकित करते हैं अथवा अभद्र भाषा का प्रयोग करते हैं, या कोई अन्य अनुचित साधन का प्रयोग करते हैं, जैसे कि अंकित किये गये उत्तर को मिटाना या सफेद स्याही से बदलना तो परीक्षा के लिये अयोग्य घोषित किये जा सकते हैं ।
9. आपको परीक्षा समाप्त होने पर प्रश्न-पुस्तिका एवं मूल OMR पत्रक निरीक्षक महोदय को लौटाना आवश्यक है और परीक्षा समाप्ति के बाद उसे अपने साथ परीक्षा भवन से बाहर न लेकर जायें । हालांकि आप परीक्षा समाप्ति पर मूल प्रश्न-पुस्तिका तथा OMR पत्रक की डुप्लीकेट प्रति अपने साथ ले जा सकते हैं ।
10. केवल नीले/काले बाल प्वाइंट पेन का ही इस्तेमाल करें ।
11. किसी भी प्रकार का संगणक (कैलकुलेटर) या लाग टेबल आदि का प्रयोग वर्जित है ।
12. गलत उत्तरों के लिए कोई नकारात्मक अंक नहीं है ।



COMPUTER SCIENCE & APPLICATIONS

Paper – III

Note : This paper contains **seventy five (75)** objective type questions of **two (2)** marks each.
All questions are compulsory.

- Beam-penetration and shadow-mask are the two basic techniques for producing color displays with a CRT. Which of the following is not true ?
 - The beam-penetration is used with random scan monitors.
 - Shadow-mask is used in raster-scan systems.
 - Beam-penetration method is better than shadow-mask method.
 - Shadow-mask method is better than beam-penetration method.

(A) I and II (B) II and III
(C) III only (D) IV only
- Line caps are used for adjusting the shape of the line ends to give them a better appearance. Various kinds of line caps used are
(A) Butt cap and sharp cap
(B) Butt cap and round cap
(C) Butt cap, sharp cap and round cap
(D) Butt cap, round cap and projecting square cap

- Given below are certain output primitives and their associated attributes. Match each primitive with its corresponding attributes :

List – I

List – II

- | | |
|--------------|----------------------------|
| a. Line | i. Type, Size, Color |
| b. Fill Area | ii. Color, Size, Font |
| c. Text | iii. Style, Color, Pattern |
| d. Marker | iv. Type, Width, Color |

Codes :

- | | a | b | c | d |
|-----|-----|-----|-----|----|
| (A) | i | ii | iii | iv |
| (B) | ii | i | iii | iv |
| (C) | iv | iii | ii | i |
| (D) | iii | i | iv | ii |

- Consider a window bounded by the lines : $x = 0$; $y = 0$; $x = 5$ and $y = 3$. The line segment joining $(-1, 0)$ and $(4, 5)$, if clipped against this window will connect the points
(A) $(0, 1)$ and $(2, 3)$
(B) $(0, 1)$ and $(3, 3)$
(C) $(0, 1)$ and $(4, 3)$
(D) $(0, 1)$ and $(3, 2)$
- Which of the following color models are defined with three primary colors ?
(A) RGB and HSV color models
(B) CMY and HSV color models
(C) HSV and HLS color models
(D) RGB and CMY color models
- In a digital transmission, the receiver clock is 0.1 percent faster than the sender clock. How many extra bits per second does the receiver receive if the data rate is 1 Mbps ?
(A) 10 bps (B) 100 bps
(C) 1000 bps (D) 10000 bps
- Given $U = \{1, 2, 3, 4, 5, 6, 7\}$
 $A = \{(3, 0.7), (5, 1), (6, 0.8)\}$
then \tilde{A} will be : (where $\sim \rightarrow$ complement)
(A) $\{(4, 0.7), (2, 1), (1, 0.8)\}$
(B) $\{(4, 0.3), (5, 0), (6, 0.2)\}$
(C) $\{(1, 1), (2, 1), (3, 0.3), (4, 1), (6, 0.2), (7, 1)\}$
(D) $\{(3, 0.3), (6, 0.2)\}$
- Consider a fuzzy set old as defined below
 $Old = \{(20, 0.1), (30, 0.2), (40, 0.4), (50, 0.6), (60, 0.8), (70, 1), (80, 1)\}$
Then the alpha-cut for $\alpha = 0.4$ for the set old will be
(A) $\{(40, 0.4)\}$
(B) $\{50, 60, 70, 80\}$
(C) $\{(20, 0.1), (30, 0.2)\}$
(D) $\{(20, 0), (30, 0), (40, 1), (50, 1), (60, 1), (70, 1), (80, 1)\}$

9. Perceptron learning, Delta learning and LMS learning are learning methods which falls under the category of
- (A) Error correction learning – learning with a teacher
 (B) Reinforcement learning – learning with a critic
 (C) Hebbian learning
 (D) Competitive learning – learning without a teacher
10. Code blocks allow many algorithms to be implemented with the following parameters :
- (A) clarity, elegance, performance
 (B) clarity, elegance, efficiency
 (C) elegance, performance, execution
 (D) execution, clarity, performance
11. Match the following with respect to the jump statements :
- | | |
|-----------------|--|
| List – I | List – II |
| a. return | i. The conditional test and increment portions |
| b. goto | ii. A value associated with it |
| c. break | iii. Requires a label for operation |
| d. continue | iv. An exit from only the innermost loop |
- Codes :**
- | | | | | |
|-----|-----|-----|----|----|
| | a | b | c | d |
| (A) | ii | iii | iv | i |
| (B) | iii | iv | i | ii |
| (C) | iv | iii | ii | i |
| (D) | iv | iii | i | ii |
12. The control string in C++ consists of three important classifications of characters
- (A) Escape sequence characters, Format specifiers and White-space characters
 (B) Special characters, White-space characters and Non-white space characters
 (C) Format specifiers, White-space characters and Non-white space characters
 (D) Special characters, White-space characters and Format specifiers

13. Match the following with respect to I/O classes in object oriented programming :

- | | |
|-----------------|-----------------------------------|
| List – I | List – II |
| a. fopen() | i. returns end of file |
| b. fclose() | ii. return for any problem report |
| c. ferror() | iii. returns 0 |
| d. feof() | iv. returns a file pointer |

Codes :

- | | | | | |
|-----|-----|-----|----|-----|
| | a | b | c | d |
| (A) | iv | i | ii | iii |
| (B) | iii | i | iv | ii |
| (C) | ii | iii | iv | i |
| (D) | iv | iii | i | ii |

14. Which one of the following describes the syntax of prolog program ?

- I. Rules and facts are terminated by full stop (.)
 II. Rules and facts are terminated by semicolon (;)
 III. Variables names must start with upper case alphabets.
 IV. Variables names must start with lower case alphabets.

Codes :

- | | |
|------------|-------------|
| (A) I, II | (B) III, IV |
| (C) I, III | (D) II, IV |

15. Let L be any language. Define even (W) as the strings obtained by extracting from W the letters in the even-numbered positions and $even(L) = \{even(W) \mid W \in L\}$. We define another language Chop (L) by removing the two leftmost symbols of every string in L given by $Chop(L) = \{W \mid v W \in L, \text{ with } |v| = 2\}$. If L is regular language then

- (A) $even(L)$ is regular and $Chop(L)$ is not regular.
 (B) Both $even(L)$ and $Chop(L)$ are regular.
 (C) $even(L)$ is not regular and $Chop(L)$ is regular.
 (D) Both $even(L)$ and $Chop(L)$ are not regular.

16. Software testing is
- (A) the process of establishing that errors are not present.
 - (B) the process of establishing confidence that a program does what it is supposed to do.
 - (C) the process of executing a program to show that it is working as per specifications.
 - (D) the process of executing a program with the intent of finding errors.

17. Assume that a program will experience 200 failures in infinite time. It has now experienced 100 failures. The initial failure intensity was 20 failures/CPU hr. Then the current failure intensity will be
- (A) 5 failures/CPU hr
 - (B) 10 failures/CPU hr.
 - (C) 20 failures/CPU hr.
 - (D) 40 failures/CPU hr.

18. Consider a project with the following functional units :
- Number of user inputs = 50
 Number of user outputs = 40
 Number of user enquiries = 35
 Number of user files = 06
 Number of external interfaces = 04
- Assuming all complexity adjustment factors and weighing factors as average, the function points for the project will be
- (A) 135
 - (B) 722
 - (C) 675
 - (D) 672

19. Match the following :

- | List – I | List – II |
|-----------------|---|
| a. Correctness | i. The extent to which a software tolerates the unexpected problems |
| b. Accuracy | ii. The extent to which a software meets its specifications |
| c. Robustness | iii. The extent to which a software has specified functions |
| d. Completeness | iv. Meeting specifications with precision |

Codes :

- | | a | b | c | d |
|-----|----|----|-----|-----|
| (A) | ii | iv | i | iii |
| (B) | i | ii | iii | iv |
| (C) | ii | i | iv | iii |
| (D) | iv | ii | i | iii |

20. Which one of the following is not a definition of error ?
- (A) It refers to the discrepancy between a computed, observed or measured value and the true, specified or theoretically correct value.
 - (B) It refers to the actual output of a software and the correct output.
 - (C) It refers to a condition that causes a system to fail.
 - (D) It refers to human action that results in software containing a defect or fault.
21. Which one of the following is not a key process area in CMM level 5 ?
- (A) Defect prevention
 - (B) Process change management
 - (C) Software product engineering
 - (D) Technology change management

22. Consider the following relational schemas for a library database :

Book (Title, Author, Catalog_no, Publisher, Year, Price)

Collection(Title, Author, Catalog_no) with the following functional dependencies :

- I. Title, Author \rightarrow Catalog_no
 - II. Catalog_no \rightarrow Title, Author, Publisher, Year
 - III. Publisher, Title, Year \rightarrow Price
- Assume (Author, Title) is the key for both schemas. Which one of the following is true ?

- (A) Both Book and Collection are in BCNF.
- (B) Both Book and Collection are in 3NF.
- (C) Book is in 2NF and Collection in 3NF.
- (D) Both Book and Collection are in 2NF.

23. Specialization Lattice stands for

- (A) An entity type can participate as a subclass in only one specialization.
- (B) An entity type can participate as a subclass in more than one specialization.
- (C) An entity type that can participate in one specialization.
- (D) An entity type that can participate in one generalization.

24. Match the following :

List – I

List – II

- | | |
|------------------------------|-----------------------|
| a. Timeout ordering protocol | i. Wait for graph |
| b. Deadlock prevention | ii. Roll back |
| c. Deadlock detection | iii. Wait-die scheme |
| d. Deadlock recovery | iv. Thomas Write Rule |

Codes :

- | | | | | |
|-----|-----|-----|----|-----|
| | a | b | c | d |
| (A) | iv | iii | i | ii |
| (B) | iii | ii | iv | i |
| (C) | ii | i | iv | iii |
| (D) | iii | i | iv | iii |

25. Consider the schema

$R = \{S, T, U, V\}$

and the dependencies

$S \rightarrow T, T \rightarrow U, U \rightarrow V$ and $V \rightarrow S$

If $R = (R_1 \text{ and } R_2)$ be a decomposition such that $R_1 \cap R_2 = \phi$

then the decomposition is

- (A) not in 2NF
- (B) in 2NF but not in 3NF
- (C) in 3NF but not in 2NF
- (D) in both 2NF and 3NF

26. Which one of the following is not a Client-Server application ?

- (A) Internet chat
- (B) Web browser
- (C) E-mail
- (D) Ping

27. Which of the following concurrency protocol ensures both conflict serializability and freedom from deadlock :

- I. 2-phase locking
- II. Time phase ordering
- (A) Both I & II
- (B) II only
- (C) I only
- (D) Neither I nor II

28. Match the following :

List – I

List – II

- | | |
|--------------------------------|--------------------------|
| a. Expert systems | i. Pragmatics |
| b. Planning | ii. Resolution |
| c. Prolog | iii. Means-end analysis |
| d. Natural language processing | iv. Explanation facility |

Codes :

- | | | | | |
|-----|-----|-----|-----|----|
| | a | b | c | d |
| (A) | iii | iv | i | ii |
| (B) | iii | iv | ii | i |
| (C) | i | ii | iii | iv |
| (D) | iv | iii | ii | i |

29. STRIPS addresses the problem of efficiently representing and implementation of a planner. It is not related to which one of the following ?
 (A) SHAKEY
 (B) SRI
 (C) NLP
 (D) None of these
30. Slots and facets are used in
 (A) Semantic Networks
 (B) Frames
 (C) Rules
 (D) All of these
31. Consider $f(N) = g(N) + h(N)$
 Where function g is a measure of the cost of getting from the start node to the current node N and h is an estimate of additional cost of getting from the current node N to the goal node. Then $f(N) = h(N)$ is used in which one of the following algorithms ?
 (A) A* algorithm
 (B) AO* algorithm
 (C) Greedy best first search algorithm
 (D) Iterative A* algorithm
32. _____predicate calculus allows quantified variables to refer to objects in the domain of discourse and not to predicates or functions.
 (A) Zero-order (B) First-order
 (C) Second-order (D) High-order
33. _____ is used in game trees to reduce the number of branches of the search tree to be traversed without affecting the solution.
 (A) Best first search
 (B) Goal stack planning
 (C) Alpha-beta pruning procedure
 (D) Min-max search

34. Consider a uniprocessor system where new processes arrive at an average of five processes per minute and each process needs an average of 6 seconds of service time. What will be the CPU utilization ?
 (A) 80 % (B) 50 %
 (C) 60 % (D) 30 %
35. Consider a program that consists of 8 pages (from 0 to 7) and we have 4 page frames in the physical memory for the pages. The page reference string is :
 1 2 3 2 5 6 3 4 6 3 7 3 1 5 3 6 3 4 2 4
 3 4 5 1
 The number of page faults in LRU and optimal page replacement algorithms are respectively (without including initial page faults to fill available page frames with pages) :
 (A) 9 and 6 (B) 10 and 7
 (C) 9 and 7 (D) 10 and 6
36. Which of the following statements is not true about disk-arm scheduling algorithms ?
 (A) SSTF (shortest seek time first) algorithm increases performance of FCFS.
 (B) The number of requests for disk service are not influenced by file allocation method.
 (C) Caching the directories and index blocks in main memory can also help in reducing disk arm movements.
 (D) SCAN and C-SCAN algorithms are less likely to have a starvation problem.

37. _____ maintains the list of free disk blocks in the Unix file system.
- (A) I-node
 - (B) Boot block
 - (C) Super block
 - (D) File allocation table

38. A part of Windows 2000 operating system that is not portable is
- (A) Device Management
 - (B) Virtual Memory Management
 - (C) Processor Management
 - (D) User Interface

39. Match the following with reference to Unix shell scripts :

List – I

List – II

- | | |
|--------|------------------------------------|
| a. \$? | i. File name of the current script |
| b. \$# | ii. List of arguments |
| c. \$0 | iii. The number of arguments |
| d. \$* | iv. Exit status of last command |

Codes :

- | | a | b | c | d |
|-----|-----|-----|---|----|
| (A) | iii | ii | i | iv |
| (B) | ii | iii | i | iv |
| (C) | iv | iii | i | ii |
| (D) | i | iii | i | iv |

40. The advantage of _____ is that it can reference memory without paying the price of having a full memory address in the instruction.
- (A) Direct addressing
 - (B) Indexed addressing
 - (C) Register addressing
 - (D) Register Indirect addressing

41. The reverse polish notation equivalent to the infix expression $((A + B) * C + D) / (E + F + G)$
- (A) A B + C * D + E F + G + /
 - (B) A B + C D * + E F + G + /
 - (C) A B + C * D + E F G + + /
 - (D) A B + C * D + E + F G + /

42. The output of a sequential circuit depends on
- (A) present input only
 - (B) past input only
 - (C) both present and past input
 - (D) past output only

43. A byte addressable computer has a memory capacity of 2^m Kbytes and can perform 2^n operations. An instruction involving 3 operands and one operator needs a maximum of
- (A) $3m$ bits
 - (B) $m + n$ bits
 - (C) $3m + n$ bits
 - (D) $3m + n + 30$ bits

44. Which of the following flip-flops is free from race condition ?
- (A) T flip-flop
 - (B) SR flip-flop
 - (C) Master-slave JK flip-flop
 - (D) None of the above

45. One of the main features that distinguish microprocessor from micro-computers is
- (A) words are usually larger in microprocessors.
 - (B) words are shorter in microprocessors.
 - (C) microprocessor does not contain I/O devices.
 - (D) None of the above.

46. The output generated by the LINUX command :

`$ seq 1 2 10`

will be

- (A) 1 2 10
- (B) 1 2 3 4 5 6 7 8 9 10
- (C) 1 3 5 7 9
- (D) 1 5 10

47. All the classes necessary for windows programming are available in the module :
- (A) win.txt (B) win.main
(C) win.std (D) MFC
48. Windows 32 API supports
- (A) 16-bit Windows
(B) 32-bit Windows
(C) 64-bit Windows
(D) All of the above
49. Superficially the term “object-oriented”, means that, we organize software as a
- (A) collection of continuous objects that incorporates both data structure and behaviour.
(B) collection of discrete objects that incorporates both discrete structure and behaviour.
(C) collection of discrete objects that incorporates both data structure and behaviour.
(D) collection of objects that incorporates both discrete data structure and behaviour.
50. The “part-whole”, or “a-part-of”, relationship in which objects representing the components of something associated with an object representing the entire assembly is called as
- (A) Association
(B) Aggregation
(C) Encapsulation
(D) Generalisation

51. The pure object oriented programming language with extensive metadata available and modifiable at run time is

- (A) Small talk (B) C++
(C) Java (D) Eiffel

52. Match the following interfaces of Java. Servlet package :

List – I

List – II

- | | |
|---------------------|--------------------------------------|
| a. Servlet Config | i. Enables Servlets to log events |
| b. Servlet Context | ii. Read data from a client |
| c. Servlet Request | iii. Write data to a client |
| d. Servlet Response | iv. To get initialization parameters |

Codes :

- | | | | | |
|-----|-----|-----|----|-----|
| | a | b | c | d |
| (A) | iii | iv | ii | i |
| (B) | iii | ii | iv | i |
| (C) | ii | iii | iv | i |
| (D) | iv | i | ii | iii |

53. The syntax of capturing events method for document object is

- (A) CaptureEvents()
(B) CaptureEvents(Orgs eventType)
(C) CaptureEvents(eventType)
(D) CaptureEvents(eventVal)

61. Given the following equalities :
- $E_1 : n^{K+\epsilon} + n^K \lg n = \theta(n^{K+\epsilon})$ for all fixed K and ϵ , $K \geq 0$ and $\epsilon > 0$.
- $E_2 : n^3 2^n + 6n^2 3^n = O(n^3 2^n)$
- Which of the following is true ?
- (A) E_1 is correct and E_2 is correct.
 (B) E_1 is correct and E_2 is not correct.
 (C) E_1 is not correct and E_2 is correct.
 (D) E_1 is not correct and E_2 is not correct.

62. Consider the fractional knapsack instance $n = 4$, $(p_1, p_2, p_3, p_4) = (10, 10, 12, 18)$, $(w_1, w_2, w_3, w_4) = (2, 4, 6, 9)$ and $M = 15$. The maximum profit is given by
- (Assume p and w denotes profit and weight of objects respectively)
- (A) 40 (B) 38
 (C) 32 (D) 30

63. The solution of the recurrence relation of $T(n) = 3T\left(\text{floor}\left(\frac{n}{4}\right)\right) + n$ is
- (A) $O(n^2)$ (B) $O(n \lg n)$
 (C) $O(n)$ (D) $O(\lg n)$

64. If h is chosen from a universal collection of hash functions and is used to hash n keys into a table of size m , where $n \leq m$, the expected number of collisions involving a particular key K is
- (A) less than 1
 (B) less than $\lg n$
 (C) greater than 1
 (D) greater than $\lg n$

65. Given the following statements :
- S_1 : The subgraph-isomorphism problem takes two graphs G_1 and G_2 and asks whether G_1 is a subgraph of G_2 .
- S_2 : The set-partition problem takes as input a set S of numbers and asks whether the numbers can be partitioned into two sets A and $\bar{A} = S - A$ such that
- $$\sum_{x \in A} x = \sum_{x \in \bar{A}} x$$

- Which of the following is true ?
- (A) S_1 is NP problem and S_2 is P problem.
 (B) S_1 is NP problem and S_2 is NP problem.
 (C) S_1 is P problem and S_2 is P problem.
 (D) S_1 is P problem and S_2 is NP problem.

66. Suppose that the splits at every level of quicksort are in the proportion $(1 - \alpha)$ to α , where $0 < \alpha \leq \frac{1}{2}$ is a constant. The minimum depth of a leaf in the recursion tree is approximately given by
- (A) $-\frac{\lg n}{\lg(1 - \alpha)}$
 (B) $-\frac{\lg(1 - \alpha)}{\lg n}$
 (C) $-\frac{\lg n}{\lg \alpha}$
 (D) $-\frac{\lg \alpha}{\lg n}$

67. Ten signals, each requiring 3000 Hz, are multiplexed on to a single channel using FDM. How much minimum bandwidth is required for the multiplexed channel ? Assume that the guard bands are 300 Hz wide.
- (A) 30,000
(B) 32,700
(C) 33,000
(D) None of the above
68. A terminal multiplexer has six 1200 bps terminals and 'n' 300 bps terminals connected to it. If the outgoing line is 9600 bps, what is the value of n ?
- (A) 4 (B) 8
(C) 16 (D) 28
69. Which of the following is used in the options field of IPv4 ?
- (A) Strict source routing
(B) Loose source routing
(C) time stamp
(D) All of the above
70. Which layers of the OSI reference model are host-to-host layers ?
- (A) Transport, Session, Presentation, Application
(B) Network, Transport, Session, Presentation
(C) Data-link, Network, Transport, Session
(D) Physical, Data-link, Network, Transport
71. A network on the Internet has a subnet mask of 255.255.240.0. What is the maximum number of hosts it can handle ?
- (A) 1024 (B) 2048
(C) 4096 (D) 8192
72. Four bits are used for packed sequence numbering in a sliding window protocol used in a computer network. What is the maximum window size ?
- (A) 4 (B) 8
(C) 15 (D) 16

73. Given the following two grammars :
- $G_1: S \rightarrow AB \mid aAB$
 $A \rightarrow a \mid Aa$
 $B \rightarrow b$
- $G_2: S \rightarrow a S b S \mid b S a S \mid \lambda$
- Which statement is correct ?
- (A) G_1 is unambiguous and G_2 is unambiguous.
(B) G_1 is unambiguous and G_2 is ambiguous.
(C) G_1 is ambiguous and G_2 is unambiguous.
(D) G_1 is ambiguous and G_2 is ambiguous.

74. Match the following :

List - I	List - II
a. Chomsky Normal form	i. $S \rightarrow b S S \mid a S \mid c$
b. Greibach Normal form	ii. $S \rightarrow a S b \mid ab$
c. S-grammar	iii. $S \rightarrow AS \mid a$ $A \rightarrow SA \mid b$
d. LL grammar	iv. $S \rightarrow a B S B$ $B \rightarrow b$

Codes :

	a	b	c	d
(A)	iv	iii	i	ii
(B)	iv	iii	ii	i
(C)	iii	iv	i	ii
(D)	iii	iv	ii	i

75. Given the following two languages :
- $L_1 = \{a^n b^n \mid n \geq 1\} \cup \{a\}$
 $L_2 = \{w C w^R \mid w \in \{a, b\}^*\}$
- Which statement is correct ?
- (A) Both L_1 and L_2 are not deterministic.
(B) L_1 is not deterministic and L_2 is deterministic.
(C) L_1 is deterministic and L_2 is not deterministic.
(D) Both L_1 and L_2 are deterministic.

Space For Rough Work