26

QUESTION PAPER SERIES CODE

A

Registration No. :

Centre of Exam. : _____

Name of Candidate : _____

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Signature of Invigilator

ENTRANCE EXAMINATION, 2015

M.Phil./Ph.D. & M.Tech./Ph.D.
COMPUTER & SYSTEM SCIENCES

[Field of Study Code : COMP—SCSP (158)/MTCP (157)]

Time Allowed : 3 hours

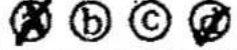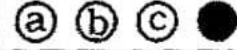*Maximum Marks* : 480
Weightage : 100

INSTRUCTIONS FOR CANDIDATES

Candidates must read carefully the following instructions before attempting the Question Paper :

(i) Write your Name and Registration Number in the space provided for the purpose on the top of this Question Paper and in the Answer Sheet.

(ii) **Please darken the appropriate Circle of Question Paper Series Code on the Answer Sheet.**

(iii) All questions are compulsory.

(iv) Answer all the 120 questions in the Answer Sheet provided for the purpose by darkening the correct choice, i.e., (a) or (b) or (c) or (d) with BALLPOINT PEN only against each question in the corresponding Circle. Any overwriting or alteration will be treated as wrong answer.

(v) Each correct answer carries 4 marks. **There will be negative marking and 1 mark will be deducted for each wrong answer.**

(vi) Answer written by the candidates inside the Question Paper will not be evaluated.

(vii) Calculators and Log Tables may be used.

(viii) Pages at the end have been provided for Rough Work.

(ix) Return the Question Paper and Answer Sheet to the Invigilator at the end of the Entrance Examination. **DO NOT FOLD THE ANSWER SHEET.**

INSTRUCTIONS FOR MARKING ANSWERS

1. Use only Blue/Black Ballpoint Pen (do not use pencil) to darken the appropriate Circle.
2. Please darken the whole Circle.
3. Darken ONLY ONE CIRCLE for each question as shown in the example below :

Wrong	Wrong	Wrong	Wrong	Correct
● ⓑ ⓒ ●	ⓧ ⓑ ⓒ ⓓ	ⓧ ⓑ ⓒ ⓧ	⊙ ⓑ ⓒ ●	ⓐ ⓑ ⓒ ●

4. Once marked, no change in the answer is allowed.
5. Please do not make any stray marks on the Answer Sheet.
6. Please do not do any rough work on the Answer Sheet.
7. Mark your answer only in the appropriate space against the number corresponding to the question.
8. **Ensure that you have darkened the appropriate Circle of Question Paper Series Code on the Answer Sheet.**

/26-A

1. Which of the following sorting algorithms has a running time that is least dependent on the initial ordering of the input?

    (a) Insertion sort

    (b) Merge sort

    (c) Quicksort

    (d) Selection sort

2. The mean of the values $0, 1, 2, ..., n$ having corresponding weights $n_{c_0}, n_{c_1}, ..., n_{c_n}$, respectively is

    (a) $\dfrac{2^n}{n+1}$

    (b) $\dfrac{2^{n+1}}{n(n+1)}$

    (c) $\dfrac{n+1}{2}$

    (d) $\dfrac{n}{2}$

3. What would be the sequence of nodes in preorder traversal of a binary tree whose inorder and postorder traversals are as under?

    Inorder   :   A E C F B D

    Postorder : E F C D B A

    (a) A B C D E F

    (b) A B C F E D

    (c) A B C E F D

    (d) None of the above

4. If a file of size $n = 1000$ takes 5 ms for sorting using the quicksort algorithm, then approximately how much time would it take to sort a file of size $n = 1000000000$? (Assume that all data are available in the main memory)

    (a) 1500000 ms

    (b) 15 ms

    (c) 150000 ms

    (d) None of the above

5. Let $R = (A,\ B,\ C,\ D,\ E,\ F)$ be a relation scheme with the following dependencies :

$$C \to F,\ E \to A,\ EC \to D,\ A \to B$$

Which of the following is a key for R?

(a) CD

(b) AE

(c) AC

(d) None of the above

6. What is the output of this C code?

```c
void main( ) {
  const int a =10;
    int *ptr = (int*)&a;
    *ptr = 20;
    clrscr( );
    printf("%d",a);
    getch( );
    }
```

(a) 10

(b) 20

(c) Error

(d) Garbage

7. The most powerful form of structural testing is

(a) function coverage testing

(b) branch coverage testing

(c) statement coverage testing

(d) path coverage testing

8. How many page faults will occur for the optimal, least recently used and clock page replacement algorithms respectively for the given page reference string?

2 3 2 1 5 2 4 5 3 2 5 2

(a) 5, 4, 3

(b) 3, 4, 5

(c) 3, 3, 4

(d) 4, 4, 5

9. The maximum frame size for a CSMA/CD network running at 1 Gbps over 1-km cable with no repeaters and a signal speed of 200000 km/sec is

    (a)   10000 bits

    (b)   5000 bits

    (c)   20000 bits

    (d)   15000 bits

10. If $(\tan\theta + \cot\theta) = 2$, the value of $(\tan^2\theta + \cot^2\theta)$ is equal to

    (a)   0

    (b)   1

    (c)   2

    (d)   4

11. CSMA with p-persistent

    (a)   sends frames immediately if the channel is idle

    (b)   senses the channel with probability p

    (c)   sends with probability p if the channel is idle

    (d)   sends with probability $1-p$ if the channel is idle

12. The major difference between a Moore and a Mealy machine is

    (a)   output of Moore machine depends on present state and input

    (b)   output of Moore machine depends on a state only

    (c)   output of Moore machine depends on output only

    (d)   None of the above

13. On a positive edge-triggered S-R flip-flop, the outputs reflect the input condition, when

    (a)   the clock pulse is low

    (b)   the clock pulse is high

    (c)   the clock pulse transitions from low to high

    (d)   the clock pulse transitions from high to low

[P.T.O.

14. Assume that an upper triangular matrix $a[0...n-1,\ 0...n-1]$ is stored in a linear array $h\left[0...\dfrac{1}{2}n(n+1)-1\right]$ in lexicographical order. If $a[0,0]$ is stored in $h[0]$, where is $a[40,50]$ stored in array h for $n=100$?

   (a) $h[3220]$

   (b) $h[3229]$

   (c) $h[3230]$

   (d) $h[3231]$

15. What is the output of this C code?

```
#define product (a, b) a*b
main( )
{
int x = 5, y = 2;
printf("%d", product(x + 4, y – 3 ));
}
```

   (a) 10

   (b) –9

   (c) 15

   (d) Error

16. The value of $\tan 15^\circ\ \tan 20^\circ\ \tan 70^\circ\ \tan 75^\circ$ is equal to

   (a) 1

   (b) $\sqrt{2}$

   (c) $2\sqrt{2}$

   (d) $2\sqrt{3}$

17. What among the following depicts a semaphore?

   (a) A program

   (b) A constant

   (c) A variable

   (d) A hardware device

18. Suppose you are given an array $s[1...n]$ and a procedure *reverse* (s, i, j) which reverses the order of elements in s between i and j (both inclusive). What does the following sequence do, where $1 \le k \le n$?

reverse $(s, 1, k)$;
reverse $(s, k+1, n)$;
reverse $(s, 1, n)$;

(a) Rotates s right by k positions

(b) Rotates s left by k positions

(c) Reverses all elements of s

(d) None of the above

19. Choose the missing term out of the given alternatives :

Poles : Magnet :: ? : Battery

(a) Energy

(b) Power

(c) Terminals

(d) Cells

20. RISC stands for

(a) Rapid Instruction Set Computer

(b) Reliable Intelligent Super Computer

(c) Reduced Instruction Set Computer

(d) Ruby Integrated Silicon Chip

21. If the hit ratio to a TLB is 80% and it takes 15 nanoseconds to search the TLB and 150 nanoseconds to access the main memory, what must be the effective access time in nanoseconds?

(a) 185

(b) 195

(c) 205

(d) 175

22. Capacity of a channel is 20 Mbps and a round-trip time is 25 µs. Frames of size 1000 bits are being transmitted. The utilization of the channel is approximately

   (a)   95%

   (b)   66%

   (c)   55%

   (d)   33%

23. Which of the following logic expressions is incorrect?

   (a) $1 \oplus 0 = 1$

   (b) $1 \oplus 1 \oplus 0 = 1$

   (c) $1 \oplus 1 \oplus 1 = 1$

   (d) $1 \oplus 1 = 0$

24. The probability density function of a random variable X is $f(x) = \dfrac{x}{2}$ in $0 \le x \le 2$. The $P(X > 1 \cdot 5 \mid X > 1)$ is equal to

   (a) $\dfrac{7}{16}$

   (b) $\dfrac{3}{4}$

   (c) $\dfrac{7}{12}$

   (d) $\dfrac{21}{64}$

25. How many inputs will a decimal-to-BCD encoder have?

   (a)   4

   (b)   8

   (c)   10

   (d)   16

26. What is the cyclomatic complexity of the following piece of code?

```
int D = 2;
for ( int i = 1; i<=3; i++ )
{ for ( int k = 1; k<=3; k++ )
  { for ( int m = 1; m<=3; m++ )
            D = D * 3;
  }
}
```

(a) 3

(b) 4

(c) 5

(d) 6

27. What is the output of this C code?

```
struct xyz
{
 char *s; int i; };
struct xyz, a, b;
a.s = (char*)malloc(6);
strcpy(a.s, "hello");
b = a;
b.s[0] = 'H';
printf("%s", a.s);
}
```

(a) There will be run time error

(b) hello

(c) Hello

(d) There is a syntax error

28. Predictive parsing is possible only for

(a) LL(k) grammar

(b) LALR(l) grammar

(c) LR(k) grammar

(d) CLR(l) grammar

29. Which of the following is not a step in object-oriented analysis using OMT?

   (a) Object modeling

   (b) Collaborative modeling

   (c) Dynamic modeling

   (d) Functional modeling

30. Which of the following will be equivalent to $\sim (p- > q)$?

   (a) $((\sim p) \vee q)$

   (b) $(\sim q- > \sim p)$

   (c) $(p \wedge \sim q)$

   (d) All of the above

31. In Unix, for some file the access permissions are modified to 764. Which of the following interpretations is valid?

   (a) Everyone can read, group can execute only and the owner can read and write

   (b) Everyone can read and write, but the owner alone can execute

   (c) Everyone can read, group including owner can write, owner alone can execute

   (d) None of the above

32. Consider a schema $R(A, B, C, D)$ and functional dependencies $A \rightarrow B$ and $C \rightarrow D$. Then the decomposition of R into $R_1(AB)$ and $R_2(CD)$ is

   (a) dependency preserving and lossless join

   (b) lossless join but not dependency preserving

   (c) dependency preserving but not lossless join

   (d) not dependency preserving and not lossless join

33. The general solution of the equation $(\sqrt{3} - 1)\sin\theta + (\sqrt{3} + 1)\cos\theta = 2$ is

   (a) $2n\pi \pm \dfrac{\pi}{4} + \dfrac{\pi}{12}$

   (b) $n\pi + (-1)^n \dfrac{\pi}{4} + \dfrac{\pi}{12}$

   (c) $2n\pi \pm \dfrac{\pi}{4} - \dfrac{\pi}{12}$

   (d) $n\pi + (-1)^n \dfrac{\pi}{4} - \dfrac{\pi}{12}$

34. Choose the missing term out of the given alternatives :

Peace : Chaos :: Creation : ?

(a) Manufacture

(b) Destruction

(c) Build

(d) Construction

35. If one uses straight two-way merge sort algorithm to sort the following elements in ascending order

20, 47, 15, 8, 9, 4, 40, 30, 12, 17

then the output after two passes would be

(a) 8, 15, 20, 47, 4, 9, 30, 40, 12, 17

(b) 8, 15, 20, 47, 4, 9, 30, 12, 17, 40

(c) 47, 20, 8, 15, 4, 9, 30, 40, 12, 17

(d) 8, 15, 20, 4, 9, 47, 30, 40, 12, 17

36. Which one of the examples given below express the commutative law of multiplication?

(a) $A + B = B + A$

(b) $AB = B + A$

(c) $AB = BA$

(d) $AB = A \times B$

37. NAND gates are preferred over others, because these

(a) have lower fabrication area

(b) can be used to make any gate

(c) consume least electronic power

(d) None of the above

38. In COCOMO model, the effort of 2 person month can correspond to

(a) 2 persons working for 1 month

(b) 1 person working for 2 months

(c) 2 unit area under the person-month plot

(d) All of the above

39. What is the output of this C code?

```
void main( ) {
    int x = 5, y = 10, z = 15, val;
    val = sum ( x, ( y = 0, z = 0, y ), z );
    clrscr( );
    printf ("%d", val);
    getch( );
}
sum (int x, int y, int z) {
    return x + y + z;
}
```

(a) 20

(b) 10

(c) 15

(d) None of the above

40. If harmonic mean of two positive integers p and q is 3 given that $\frac{6p+1}{7q-4} < \frac{p}{q}$, what could be the value of q?

(a) $q \le 4$

(b) $q > 9$

(c) $q < 8$

(d) $q \ge 13$

41. Among the following, which is not a Horn clause?

(a) P

(b) $\neg p \vee q$

(c) $p \rightarrow q$

(d) $p \rightarrow \neg q$

42. Let $f(x) = x^2$ be a function over the set of real numbers. Which of the following is true?

(a) f is invertible

(b) f is not invertible

(c) f is one-to-one

(d) Not possible to determine

43. Choose the missing term out of the given alternatives :

Architect : Building :: Sculptor : ?

    (a)   Museum

    (b)   Statue

    (c)   Chisel

    (d)   Stone

44. Standard FTP uses reserved port(s)

    (a)   20

    (b)   25

    (c)   20 and 21

    (d)   25 and 23

45. When simplified with Boolean algebra $(x + y)(x + z)$ simplifies to

    (a) x

    (b) $x + x(y + z)$

    (c) $x(1 + yz)$

    (d) $x + yz$

46. The minimum number of nodes in an AVL tree (height-balanced binary tree) of height = 9 is

(a) 54

(b) 64

(c) 87

(d) None of the above

47. Sliding Window Protocol with selective reject/repeat gives better performance than other protocols, when

(a) buffer is limited and bandwidth is sufficient

(b) buffer is sufficient and bandwidth is limited

(c) buffer is limited and bandwidth is limited

(d) buffer is sufficient and bandwidth is sufficient

48. Three integers are chosen at random from the first 20 integers. The probability that their product is even, is

(a) $\dfrac{2}{9}$

(b) $\dfrac{3}{29}$

(c) $\dfrac{17}{19}$

(d) $\dfrac{4}{19}$

49. What happens if the base and derived class contain definitions of a function with same prototype?

   (a)   Compiler reports an error on compilation

   (b)   Only base class function will get called irrespective of the object

   (c)   Only derived class function will get called irrespective of the object

   (d)   Base class object will call base class function and derived class object will call derived class function

50. What is the heuristic function of greedy best-first search?

   (a) $f(n)! = h(n)$

   (b) $f(n) < h(n)$

   (c) $f(n) = h(n)$

   (d) $f(n) > h(n)$

51. How many spanning trees are possible in $K_{2,s}$?

   (a) $S.2^{s-1}$

   (b) $S.2^{s}$

   (c) 2^{s}

   (d) 2^{s-1}

52. If FRIEND is coded as HUMJTK, how can CANDLE be written in that code?

   (a)   DEQJQM

   (b)   DCQHQK

   (c)   EDRIRL

   (d)   ESJFME

53. The number of generators in the group $<Z_7^*, 7^*>$ is

   (a)   1

   (b)   2

   (c)   3

   (d)   4

54. Which of the following is true in context of alpha-beta search procedure?

   (a)   The alpha values of MAX nodes can never decrease

   (b)   The beta values of MIN nodes can never decrease

   (c)   Search can be discontinued below any MIN node having beta value less than or equal to alpha value of any of its MAX node ancestors

   (d)   All of the above

55. An algebraic structure is monoid if it possesses one of the following properties

   (a)   Closure and Associative

   (b)   Closure, Associative and Commutative

   (c)   Closure, Associative and Identity

   (d)   Closure, Associative, Identity and Inverse

56. If A and B are acute angles and $\sin A = \cos B$, then the value of $A + B$ is equal to

   (a)   30°

   (b)   75°

   (c)   90°

   (d)   180°

57. The productions $E \rightarrow E + E \mid E - E \mid E * E \mid id$

    (a) generate an inherently ambiguous language

    (b) generate an ambiguous language

    (c) are ambiguous

    (d) None of the above

58. In a certain code ADVENTURES is written as TRDESAUVEN. How is PRODUCED written in that code?

    (a) IUIPGSSRNP

    (b) IUIPGSRSNR

    (c) IUINGSSRRP

    (d) IRIPGSSNRR

59. If FRAGRANCE is written as SBHSBODFG, how can IMPOSING be written?

    (a) NQPTJHOJ

    (b) NQPTJOHJ

    (c) NQTPJOHJ

    (d) NQPTJOHI

60. Which of the following is true for Chomsky hierarchy?

    (a) There are some regular sets that are not context-free

    (b) The set of type 0 language is a proper subset of set of type 1 languages

    (c) It is a hierarchy of four classes of languages

    (d) It is a hierarchy of four types of grammar rules

61. $5^{2n} - 1$ is divisible by

    (a) 5

    (b) -5

    (c) 24

    (d) -24

[P.T.O.

/26-**A**

62. If PALE is coded as 2134, EARTH is coded as 41590, how can PEARL be coded in that language?

   (a) 25430

   (b) 29530

   (c) 25413

   (d) 24153

63. Which one of the following regular expressions is false?

   (a) $(r^*)^* = r^*$

   (b) $r_1^* (r_1 + r_2)^* = (r_1 + r_2)^*$

   (c) $(r_1 + r_2)^* = (r_1^* r_2^*)^*$

   (d) None of the above

64. If ROSE is coded as 6821, CHAIR is coded as 73456 and PREACH is coded as 961473, what will be the code for SEARCH?

   (a) 216473

   (b) 246173

   (c) 214673

   (d) 214763

65. Which one of the following is true?

   (a) Mean + Mode = 3 (Mean – Median)

   (b) Mean – Mode = 3 (Mean – Median)

   (c) Mean – Mode = 3 (Mean + Median)

   (d) Mean + Mode = 3 (Mean + Median)

66. If in a certain code, GLAMOUR is written as IJCNMWP and MISRULE is written as OGUSSNC, then how will TOPICAL be written in that code?

    (a) VMRJECN

    (b) VMRHAGJ

    (c) VMRJACJ

    (d) VNRJABJ

67. ϕ^* (Kleene's closure of ϕ, where ϕ is the empty language over Σ) is equivalent to

    (a) ϕ

    (b) λ (null string)

    (c) Σ

    (d) None of the above

68. If BE QUICK is coded as ZC OSGAI, then the code of the last letter of the third word in the sentence I LOVE MY COUNTRY is

    (a) A

    (b) T

    (c) Y

    (d) W

69. If ZEBRA can be written as 2652181, how can COBRA be written?

    (a) 302181

    (b) 3152181

    (c) 31822151

    (d) 1182153

70. Let $S = \{A, C, T, G\}$. The number of all subsets (power set) of S is

   (a) 4

   (b) 8

   (c) 16

   (d) 32

71. If 'eraser' is called 'box', 'box' is called 'pencil', 'pencil' is called 'sharpener', and 'sharpener' is called 'bag', what will a child write with?

   (a) Eraser

   (b) Bag

   (c) Pencil

   (d) Sharpener

72. Let $f(x) = \begin{cases} |x|, & 0 < |x| \leq 2 \\ 1, & x = 0 \end{cases}$. Then at $x = 0$, f has

   (a) a local maximum

   (b) no local maximum

   (c) a local minimum

   (d) no extremum

73. Which one of the following does not define abstraction?

   (a) It focuses on observable behavior of an object

   (b) It denotes the essential characteristics of an object that distinguishes it from all other kinds of objects

   (c) It supplements encapsulation

   (d) It provides crisply defined conceptual boundaries relative to the perspective of the viewer

74. Based on the following statements, which is the correct conclusion drawn?

Only gentlemen can become members of the club. Many of the members of the club are officers. Some of the officers have been invited for dinner.

(a) All the members of the club have been invited for dinner

(b) Some of the officers are not gentlemen

(c) All gentlemen are members of the club

(d) Only gentlemen have been invited for dinner

75. The total number of functions mapping from set X to set Y, where $X = \{a, b, c\}$ and $Y = \{1, 2\}$, is

(a) 2

(b) 4

(c) 8

(d) 16

76. Of the following statements, two of which cannot be true, but both can also be false. Which are these two statements?

I. All machines make noise

II. Some machines are noisy

III. No machine makes noise

IV. Some machines are not noisy

(a) I and II

(b) III and IV

(c) I and III

(d) II and IV

77. Which one of the following is not a function?

(a) $x^2 = y$

(b) $y^2 = x$

(c) $x = y^3$

(d) $y = x^3$