# BPSC
# Lecturer

## Previous Year Paper
### CS 2015

16/L/32-2015

Serial No.

Question Booklet Series

Question Booklet **A**

# COMPUTER SCIENCE & INFORMATION TECHNOLOGY

**( Objective )**

**Time Allowed : 2 Hours** | **Maximum Marks : 50**

**Read the following instructions carefully before you begin to answer the questions.**

## IMPORTANT INSTRUCTIONS

1. This Question Booklet contains **100** questions in all.
2. **All** questions carry equal marks.
3. Attempt **all** questions.
4. **Immediately after commencement of the examination, you should check up your Question Booklet and ensure that the Question Booklet Series is printed on the top right-hand corner of the Booklet and the Booklet contains 20 printed pages and no page or question is missing or unprinted or torn or repeated. If you find any defect in this Booklet, get it replaced immediately by a complete Booklet of the same series.**
5. You must write your Roll Number in the space provided on the top of this page. Do not write anything else on the Question Booklet.
6. An OMR Answer Sheet will be supplied to you separately by the Invigilator to mark the answers. **You must write your Name, Roll No. and other particulars on the first page of the OMR Answer Sheet provided, failing which your OMR Answer Sheet will not be evaluated.**
7. You will encode your **Roll Number** and the **Question Booklet Series A, B, C or D** as it is printed on the top right-hand corner of this Question Booklet with Black/Blue ballpoint pen in the space provided on **Page–2** of your OMR Answer Sheet. **If you do not encode or fail to encode the correct series of your Question Booklet, your OMR Answer Sheet will not be evaluated correctly.**
8. Questions and their responses are printed in English only in this Booklet. Each question comprises **four** responses—(A), (B), (C) and (D). You are to select ONLY ONE correct response and mark in your OMR Answer Sheet. In case you feel that there are more than one correct response, mark the response which you consider the best. In any case, choose ONLY ONE response for each question. Your total marks will depend on the number of correct responses marked by you in the OMR Answer Sheet.
9. In the OMR Answer Sheet, there are **four** circles—Ⓐ, Ⓑ, Ⓒ and Ⓓ against each question. To answer the questions you are to **mark with Black/Blue ballpoint pen** ONLY ONE circle of your choice for each question. Select one response for each question in the Question Booklet and mark in the OMR Answer Sheet. If you mark more than one answer for one question, the answer will be treated as wrong. **Any erasure or change is not allowed.**
10. You should not remove or tear off any sheet from the Question Booklet. You are not allowed to take this Question Booklet and the OMR Answer Sheet out of the Examination Hall during the examination. **After the examination has concluded, you must hand over your OMR Answer Sheet to the Invigilator.** Thereafter, you are permitted to take away the Question Booklet with you.
11. Failure to comply with any of the above instructions will render you liable to such action o penalty as the Commission may decide at their discretion.

1. The propositional statement

$$(P \rightarrow (Q \vee R)) \rightarrow ((P \wedge Q) \rightarrow R)$$

is

(A) satisfiable but not valid

(B) valid

(C) a contradiction

(D) None of the above

2. Let $G$ be a simple connected planar graph with 13 vertices and 19 edges. Then the number of faces in the planar embedding of the graph is

(A) 0

(B) 8

(C) 9

(D) 13

3. Consider the following recurrence relation :

$T(1) = 1$

$T(n+1) = T(n) = [\sqrt{n^2+1}]$, $\forall\ n \geq 1$

The value of $T(m^2)$ for $m \geq 1$ is

(A) $\frac{m}{6}(21m - 39) + 4$

(B) $\frac{m}{6}(4m^2 - 3m + 5)$

(C) $\frac{m}{2}(3m^{2.5} - 11m + 20) - 5$

(D) $\frac{m}{6}(5m^3 - 34m^2 - 137m - 104 + \frac{5}{6})$

4. Let $G$ be an arbitrary graph with $n$ modes and $k$ components. If a vertex is removed from $G$, the number of components in the resultant graph must necessarily lie between

(A) $k$ and $n$

(B) $k-1$ and $k+1$

(C) $k-1$ and $n-1$

(D) $k+1$ and $n-k$

5. Which of the following statements is/are true for undirected graphs?

$P$ : Number of odd degree vertices is even

$Q$ : Sum of degree of all vertices is even

(A) Only $P$

(B) Only $Q$

(C) Both $P$ and $Q$

(D) Neither $P$ nor $Q$

6. What is the correct translation of the following statement into mathematical logic?

"Some real numbers are rational."

(A) $\exists x$ (rational $(x) \rightarrow$ real $(x)$)

(B) $\forall x$ (real $(x) \rightarrow$ rational $(x)$)

(C) $\exists x$ (real $(x) \wedge$ rational $(x)$)

(D) $\exists x$ (real $(x) \vee$ rational $(x)$)

**7.** A student appears for tests I, II and III. The student is successful if he passes in tests I, II or I, III. The probabilities of the student passing in tests I, II and III are respectively $p$, $q$ and $\frac{1}{2}$. If the probability of the student to be successful is $\frac{1}{2}$, then

(A) $p(1+q)=1$

(B) $q(1+p)=1$

(C) $pq=1$

(D) $\frac{1}{p}+\frac{1}{q}=1$

**8.** On a chessboard, small squares are either black or white, set alternately. Three pawns are placed at random on three squares of the chessboard. The probability that two are on the squares of the same colour is

(A) $\frac{8}{21}$

(B) $\frac{5}{21}$

(C) $\frac{16}{21}$

(D) None of the above

**9.** One hundred identical coins, each with probability $p$ of showing up head, are tossed. If $0<p<1$ and the probability of heads showing on 50 coins is equal to that of heads showing on 51 coins, then the value of $p$ is

(A) $\frac{1}{2}$ (B) $\frac{49}{101}$

(C) $\frac{50}{101}$ (D) $\frac{51}{101}$

**10.** The joint density function of the random variables $X$ and $Y$ is given by

$$f(x,y)=\begin{cases}\frac{xy}{96}, & 0<x<4,\ 1<y<5\\ 0, & \text{otherwise}\end{cases}$$

Then $E(X)$ is

(A) $\frac{3}{8}$ (B) $\frac{8}{3}$

(C) $\frac{1}{12}$ (D) $\frac{7}{12}$

**11.** In a normal population, 15·67% is less than 34 and 2·28% is more than 63. The standard deviation of the distribution is

(A) 4 (B) 9·35

(C) 2 (D) 3

12. In a town, 10 accidents took place in a span of 50 days. Assuming that the number of accidents per day follows the Poisson distribution, the probability that there will be two or more accidents in a day is (given $e^{-0.2} = 0.8182$)

(A) 0·012 (B) 0·001

(C) 0·003 (D) 0·01756

13. If $R$ is a reflexive relation on a finite set $A$ having $n$ elements and let $m$ be the order pairs in $R$, then

(A) $m \geq n$

(B) $m \leq n$

(C) $m = n$

(D) None of the above

14. $f(x) = |\sin x|$ has an inverse of its domain

(A) $[0, \pi]$

(B) $\left[0, \frac{\pi}{2}\right]$

(C) $\left[-\frac{\pi}{4}, \frac{\pi}{4}\right]$

(D) None of the above

15. The inclusion of which o following sets into

$S = \{\{1, 2\}, \{1, 2, 3\}, \{1, 3, 5\}, \{1, 2, 4\}, \{1, 2, 3, 4, 5\}$

is necessary and sufficient make $S$ a complete lattice und the partial order defined by th containment?

(A) $\{1\}$

(B) $\{1\}, \{2, 3\}$

(C) $\{1\}, \{1, 3\}$

(D) $\{1\}, \{1, 3\}, \{1, 2, 3, 4\}$ $\{1, 2, 3, 5\}$

16. The smallest odd order for no abelian group is

(A) 9 (B) 15

(C) 21 (D) 23

17. $m$ parallel lines in a plane are intersected by a family of $n$ parallel lines. The total number of parallelograms so formed is

(A) $\frac{(m-1)(n-1)}{4}$

(B) $\frac{mn}{4}$

(C) $\frac{m(m-1)\, n(n-1)}{2}$

(D) $\frac{mn(m-1)(n-1)}{4}$

18. The sides $AB$, $BC$, $CA$ of a triangle $ABC$ have 3, 4 and 5 interior points respectively on them. The total number of triangles that can be constructed by using these points as vertices is

(A) 220

(B) 204

(C) 205

(D) 195

19. The number of ways in which ₹ 18 can be distributed amongst four persons such that nobody receives less than ₹ 4 is

(A) $4^2$

(B) $2^5$

(C) 4!

(D) None of the above

20. The total number of seven-digit numbers, the sum of whose digits is even, is

(A) 9000000

(B) 4500000

(C) 8100000

(D) None of the above

21. The sum of digits in the unit place of all the numbers formed with the help of 3, 4, 5, 6 taken all at a time is

(A) 432

(B) 108

(C) 36

(D) 18

22. The number of dissimilar terms in the expansion of $(x+y+z)^n$ is

(A) $\frac{n(n+1)}{2}$

(B) $\frac{(n+1)(n+2)}{2}$

(C) $\frac{(n+2)(n+3)}{2}$

(D) None of the above

23. The eigenvalues of idempotent matrix are

(A) 0 and −1 only

(B) 0 only

(C) 0 and 1 only

(D) −1 and 1 only

**24.** Let the characteristic equation of a matrix $M$ be $\lambda^2 - \lambda - 1 = 0$, then

(A) $M^{-1}$ does not exist

(B) $M^{-1}$ exists but cannot determined from the data

(C) $M^{-1} = M + 1$

(D) $M^{-1} = M - 1$

**25.** The rank of skew-symmetric matrix cannot be

(A) 1

(B) 2

(C) 4

(D) 0

**26.** All the eigenvalues of the matrix

$$\begin{bmatrix} 1 & 2 & 0 \\ 2 & 1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$$

lie in the disc

(A) $|\lambda + 1| \leq 1$

(B) $|\lambda - 1| \leq 1$

(C) $|\lambda + 1| \leq 0$

(D) $|\lambda - 1| \leq 2$

**27.** Let $a$, $b$, $c$ be positive rea numbers. The system o equations in $x$, $y$ and $z$

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} - \frac{z^2}{c^2} = 1, \quad \frac{x^2}{a^2} - \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1,$$

$$-\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$$

has

(A) no solution

(B) unique solution

(C) infinitely many solutions

(D) finitely many solutions

**28.** The number of linea independent entries in a skew-symmetric matrix of order $n$ equals

(A) $n$

(B) $\frac{n(n+1)}{2}$

(C) $\frac{n(n-1)}{2}$

(D) $n^2 - 1$

**29.** Which of the following statements applies to the bisection method used for finding roots of functions?

(A) It converges within a few iteration

(B) It is guaranteed to work for all continuous functions

(C) It is faster than the Newton-Raphson method

(D) It requires that there will be no error in determining the sign of the function

**30.** The Newton-Raphson method is used to find the roots of the equation $x^2 - 2 = 0$, if iterations are started from $-1$ and the iterations

(A) will be converged to $-1$

(B) will be converged to $\sqrt{2}$

(C) will be converged to $-\sqrt{2}$

(D) will not be converged

**31.** In interpolation, if $x_0, x_1, \ldots, x_n$ are $(n+1)$ distinct values of real-valued function $f(x)$, then

(A) one has a polynomial $p_n(x_i) = f(x)$ of degree $n$

(B) one has a polynomial $p_n(x_i) = f(x)$ of degree $n$ exactly

(C) one has a polynomial $p_n(x_i) = f(x)$ of degree $n$ or less

(D) None of the above

**32.** Which of the following is true for backward difference operator?

(A) $\nabla^2 f(x) = f(x-2h) - 2f(x-h) + f(x)$

(B) $\nabla^2 f(x) = f(x-2h) + 2f(x-h) + f(x)$

(C) $\nabla^2 f(x) = f(x-2h) - 2f(x-h) - f(x)$

(D) None of the above

**33.** The initial value problem has at least one solution $y(x)$. This is

(A) uniqueness theorem for initial value problem

(B) existence theorem for initial value problem

(C) Green's theorem

(D) None of the above

**34.** The value of $f(x)$ given only at

$$x = 0, \frac{1}{3}, \frac{2}{3}, 1$$

Which of the following can be used to evaluate $\int_0^1 f(x)$ approximately?

(A) Trapezoidal rule

(B) Simpson's rule

(C) Trapezoidal as well as Simpson's rule

(D) None of the above

35. If $f(x)$ is continuous at $x = 0$ and $f(0) = 2$, then

$$\lim_{x \to 0} \int_0^x \frac{f(x)\,dx}{x}$$

is

(A) 0

(B) 2

(C) $f(2)$

(D) None of the above

36. If $g(x)$ is the inverse of an invertible function $f(x)$ which is differentiable at $x = c$, then $g'(f(c))$ equals

(A) $f'(c)$

(B) $\frac{1}{f'(c)}$

(C) $f(c)$

(D) None of the above

37. The value of the integral

$$\int_{-2}^{4} x\lfloor x \rfloor dx$$

is

(A) $\frac{41}{2}$

(B) 20

(C) $\frac{21}{2}$

(D) None of the above

38. The value of

$$\lim_{n \to \infty} \left[\left(1+\frac{1}{n}\right)\left(1+\frac{2}{n}\right)\left(1+\frac{3}{n}\right)\cdots(2)\right]^{\frac{1}{n}}$$

is

(A) $\frac{4}{e}$

(B) $\frac{e}{4}$

(C) $4e$

(D) None of the above

39. The area bounded by the $y$-axis $y = \cos x$ and $y = \sin x$, $0 \le x \le \frac{\pi}{2}$ is

(A) $2(\sqrt{2}-1)$ (B) $\sqrt{2}-1$

(C) $\sqrt{2}+1$ (D) $\sqrt{2}$

40. If

$$u = xf\left(\frac{y}{x}\right) + \phi\left(\frac{y}{x}\right)$$

then $xu_x + yu_y$ is equal to

(A) $xf$

(B) $\phi$

(C) $f + \phi$

(D) None of the above

41. All possible numbers of K-maps of 5 Boolean variables are

(A) $2^5$

(B) $2^2 \times 2^2 \times 2^2 \times 2^2 \times 2^2$

(C) $2^2 \times 2^5$

(D) $2^{32}$

42. Consider the following C code fragment :

```
int *pa, *pb;
int a, b;
pa = &a; pb = &b;
*pa = 25;
pb = pa;
printf ("%d \t %d\n", a, b);
```

The output of this code is

(A) 25, 25

(B) 25, unknown

(C) unknown, 25

(D) unknown, unknown

43. The average memory access in a computer takes 24 ns (nanoseconds). It is known that memory access time on miss is 60 ns and with cache is 15 ns. Hit ratio for this system is

(A) 0·9

(B) 0·8

(C) 0·85

(D) 0·95

44. Let $A = \{0, 1\} \times \{0, 1\} \times \{0, 1\}$ and $B = \{a, b, c\} \times \{a, b, c\} \times \{a, b, c\}$. Suppose $A$ is listed in lexicographic order based on $0 < 1$ and $B$ is listed in lexicographic order based on $a < b < c$. If $A \times B \times A$ is listed in lexicographic order, then the next element after $\langle (1, 1, 0), (a, b, c), (1, 1, 1) \rangle$ is

(A) $\langle (1, 1, 1), (a, c, c), (0, 0, 0) \rangle$

(B) $\langle (1, 1, 0), (b, a, a), (0, 0, 1) \rangle$

(C) $\langle (1, 1, 0), (a, c, a), (0, 0, 0) \rangle$

(D) $\langle (1, 1, 1), (a, c, a), (0, 0, 0) \rangle$

45. One-byte data $d_7 d_6 \cdots d_2 d_1 d_0$ is transmitted from $A$ to $B$. Here $d_0$ represents LSB (least significant bit). If transmitted value is 244 and received value is 237, bits in error are

(A) $d_4 d_3 d_1$

(B) $d_4 d_3 d_0$

(C) $d_5 d_3 d_0$

(D) Insufficient data to infer correct results

46. Inserting a NOT gate between inputs of a $J$-$K$ flip-flop results in

(A) $S$-$R$ flip-flop

(B) NAND gate

(C) $T$ flip-flop

(D) $D$ flip-flop

47. $A$ is set of all English alphabets and $D$ is set of digits

$A = \{'a', 'b', \cdots, 'y', 'z', 'A', 'B', \cdots, 'Y', 'Z'\}$

$D = \{'0', '1', \cdots, '8', '9'\}$

An identifier in C can be correctly described by which of the following regular expressions?

(A) $ba^* | b$, $a \in A$, $b \in A \cup D$

(B) $b^*$, $b \in A \cup D$

(C) $a^* b^*$, $a \in A$, $b \in D$

(D) $ab^*$, $a \in A$, $b \in A \cup D$

48. Consider the following pseudo-code applied on a binary tree :

```
ComputeX (node) {
  if (node == NULL)
    return 0
  else
    lvalue = ComputeX (node->
                       leftChild);
    rvalue = ComputeX (node->
                       rightChild);
    return (1+max (lvalue,
                   rvalue));
  endif
}
```

The value returned by ComputeX (root) is

(A) number of leaf nodes in the tree

(B) number of nodes in the tree

(C) number of internal nodes in the tree

(D) height of the tree

49. Consider the following C code fragment :

```
unsigned char a, b, flag;
char num;
a = 8;
b = a << 4;
flag = num & b;
```

The value of 'flag' is true if and only if

(A) LSB (least significant bit) of 'num' is one

(B) MSB (most significant bit) of 'num' is one

(C) LSB (least significant bit) of 'num' is zero

(D) MSB (most significant bit) of 'num' is zero

50. Match the terms in Column—I to those in Column—II :

| *Column—I* | *Column—II* |
|---|---|
| a. Interrupt | 1. von Neumann |
| b. Pipeline | 2. I/O Device |
| c. Stored Program | 3. Cycle Stealing |
| d. DMA | 4. Fetch-Decode-Execute |

*Codes* :

| | a | b | c | d |
|---|---|---|---|---|
| (A) | 4 | 2 | 1 | 3 |
| (B) | 2 | 4 | 1 | 3 |
| (C) | 2 | 4 | 3 | 1 |
| (D) | 4 | 3 | 1 | 2 |