GATE CS 2015 SET-2

EE25BTECH11052 - Shriyansh Kalpesh Chawda

Q. No. 1 – 5 Carry One Mark Each

1) Based on the given statements, select the most appropriate option to solve the given question
What will be the total weight of 10 poles each of same weight?
Statements: (*I*) One fourth of the weight of a pole is 15kg.
(*II*) The total weight of these poles is 160 kg more than the total weight of two poles
(GATE CS 2015)

a) Statement I alone is not sufficient
b) Statement II alone is not sufficient
c) Either I or II alone is sufficient
d) Both statements I and II together are not sufficient.

2) Consider a function $f(x) = 1 - |x|$ on $-1 < x < 1$ The value of x at which the function attains a maximum, and the maximum value of the function are.
(GATE CS 2015)

a) 0, −1 b) −1, 0 c) 0, 1 d) −1, 2

3) A generic term that include various items of clothing such as a skirt, a pair of trousers and a shirt is
(GATE CS 2015)

a) fabric b) textile c) fibre d) apparel

4) Choose the statement where underlined word is used correctly.
(GATE CS 2015)

a) The industrialist load a personnel jet.
b) I write my experience in my personnel diary.
c) All personnel are being given the day off.
d) Being religious is a personnel aspect.

5) We _____ our friend's birthday and we _____ how to make it up to him.
(GATE CS 2015)

a) Completely forgot — don't just know
b) Forgot completely — don't just know
c) Completely forgot — just don't know
d) Forgot completely — just don't know

6) In a triangle PQR, PS is the angle bisector of $\angle QPR$ and $\angle QPS = 60°$.

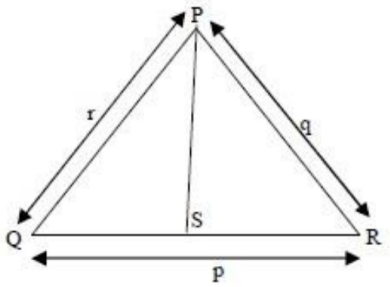

Fig. 1

What is the length of PS?

(GATE CS 2015)

a) $\frac{q+r}{qr}$ b) $\frac{qr}{q+r}$ c) $\frac{q+r}{2\sqrt{2}}$ d) $\frac{q+r}{2qr}$

7) Out of the following four sentences, select the most suitable sentence with respect to grammar and usage.

(GATE CS 2015)

a) Since the report lacked needed information, it was of no use to them.
b) The report was useless to them because there were no needed information in it.
c) Since the report did not contain the needed information, it was not real useful to them
d) Since the report lacked needed information, it would not had been useful to them.

8) If the list of letters, P, R, S, T, U is an arithmetic sequence, which of the following are also in arithmetic sequence?
I. $2P^2, 2R^2, 2S^2, 2T^2, 2U^2$
II. $P-3, R-3, S-3, T-3, U-3$
III. P^2, R^2, S^2, T^2, U^2

(GATE CS 2015)

a) I only b) I and II c) II and III d) I and III

9) If p, q, r, s are distinct integers such that:

$$f(p,q,r,s) = \max(p,q,r,s)$$

$$g(p,q,r,s) = \min(p,q,r,s)$$

$$h(p,q,r,s) = \text{remainder of } \frac{p+q}{r+s} \text{ if } (p+q) \geq (r+s)$$

or remainder of $\frac{r+s}{p+q}$ if $(r+s) > (p+q)$
Also a function $fgh(p,q,r,s) = f(p,q,r,s) \times g(p,q,r,s) \times h(p,q,r,s)$
Also the same operations are valid with two variable functions of the form $f(p,q)$
What is the value of $fg(h(2,5,7,3),4,6,8)$?

(GATE CS 2015)

10) Four branches of a company are located at M, N, O and P. M is north of N at a distance of 4km: P is south of O at a distance of 2 km: N is southeast of O by 1 km. What is the distance between M and P in km?

(GATE CS 2015)

a) 5.34 b) 6.74 c) 28.5 d) 45.49

COMPUTER SCIENCE AND ENGINEERING

Q. No. 1 - 25 Carry One Mark Each

1) An unordered list contain n distinct elements. The number of comparisons to find an element in this list that is neither maximum nor minimum is

(GATE CS 2015)

a) $\Theta(n \log n)$ b) $\Theta(n)$ c) $\Theta(\log n)$ d) $\Theta(1)$

2) Let R be the relation on the set of positive integers such that aRb if and only if a and b are distinct and have a common divisor other than 1. Which one of the following statements about R is true?

(GATE CS 2015)

a) R is symmetric and reflexive but not transitive
b) R is reflexive but not symmetric and not transitive
c) R is transitive but not reflexive and not symmetric
d) R is symmetric but not reflexive and not transitive

3) Consider the following transaction involving two bank account x and y.
read (x) ; $x := x - 50$; write (x) ; read (y); $y := y + 50$; write (y)
The constraint that the sum of the accounts x and y should remain constant is that of

(GATE CS 2015)

a) Atomicity b) Consistency c) Isolation d) Durability

4) A binary tree T has 20 leaves. The number of nodes in T having two children is _____.

(GATE CS 2015)

5) Consider the basic COCOMO model where E is the effort applied in person-months, D is the development time in chronological months, KLOC is the estimated number of delivered lines of code (*inthousands*) and a_b, b_b, c_b, d_b have their usual meanings. The basic COCOMO equations are of the form

(GATE CS 2015)

a) $E = a_b(\text{KLOC})^{\exp(b_b)}, D = c_b(E)^{\exp(d_b)}$
b) $D = a_b(\text{KLOC})^{\exp(b_b)}, E = c_b(D)^{\exp(d_b)}$
c) $E = a_b^{\exp(b_b)}, D = c_b(\text{KLOC})^{\exp(d_b)}$
d) $E = a_b^{\exp(D)}, D = c_b(\text{KLOC})^{\exp(b_b)}$

6) Consider the following two statements.
S_1: If a candidate is known to be corrupt, then he will not be elected
S_2: If a candidate is kind, he will be elected
Which one of the following statements follows from S_1 and S_2 per sound inference rules of logic?

(GATE CS 2015)

a) If a person is known to corrupt, he is kind
b) If a person is not known to be corrupt, he is not kind
c) If a person is kind, he is not known to be corrupt
d) If a person is not kind, he is not known to be corrupt

7) Assume that for a certain processor, a read request takes 50 nanoseconds on a cache miss and 5 nanoseconds on a cache hit. Suppose while running a program, it was observed that 80% of the processors read requests result in a cache hit. The average and access time in nanoseconds is _____.

(GATE CS 2015)

8) A system has 6 identical resources and N processes competing for them. Each process can request atmost 2 resources. Which one of the following values of N could lead to a deadlock?

(GATE CS 2015)

a) 1 b) 2 c) 3 d) 4

9) Consider a complete binary tree where the left and the right subtrees of the root are max-heaps. The lower bound for the number of operations to convert the tree to a heap is

(GATE CS 2015)

a) $\Theta(\log n)$ b) $\Theta(n)$ c) $\Theta(n \log n)$ d) $\Theta\left(n^2\right)$

10) In the context of abstract-syntax-tree (AST) and control-flow-graph (CFG), which one of the following is TRUE?

(GATE CS 2015)

a) In both AST and CFG, let node, N_2 be the successor of node N_1. In the input program, the code corresponding to N_2 is present after the code corresponding in N_1.
b) For any input program, neither AST nor CFG will contain a cycle
c) The maximum number of successors of a node in an AST and a CFG depends on the input program
d) Each node is AST and CFG corresponds to at most one statement in the input program

11) With reference to the B+ tree index of order 1 shown below, the minimum number of nodes (*includingtheRootnode*) that must be fetched in order to satisfy the following query: "Get all records with a search key greater than or equal to 7 and less than 15" is _____

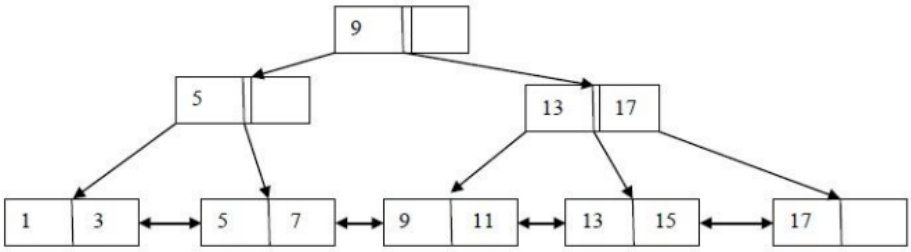

Fig. 2

(GATE CS 2015)

12) A software requirements specification (SRS) document should avoid discussing which one of the following?

(GATE CS 2015)

a) User interface issues
b) Non-functional requirements
c) Design specification
d) Interfaces with third party software

13) Identify the correct order in which a server process must invoke the function calls accept, bind, listen, and recv according to UNIX socket APL

(GATE CS 2015)

a) listen, accept, bind recv
b) bind, listen, accept, recv
c) bind, accept, listen, recv
d) accept, listen, bind recv

14) The larger of the two eigen values of the matrix $\begin{pmatrix} 4 & 5 \\ 2 & 1 \end{pmatrix}$ is _____

(GATE CS 2015)

15) The cardinality of the power set of $(0, 1, 2, ...10)$ is _____

(GATE CS 2015)

16) Which one of the following statements is NOT correct about HTTP cookies?

(GATE CS 2015)

a) A cookie is a piece of code that has the potential to compromise the security of an internet user
b) A cookie gains entry to the user's work area through an HTTP header
c) A cookie has an expiry date and time
d) Cookies can be used to track the browsing pattern of a user at a particular site

17) Consider the following function written the C programming language.

```
void foo (char * a) {
if (*a && *a! = ' ') {
putchar (*a);
}
}
```

The output of the above function on input "ABCD EFGH" is

(GATE CS 2015)

a) ABCD EFGH b) ABCD c) HGFE DCBA d) DCBA

18) A link has a transmission speed of 10^6 bits/sec. It uses data packets of size 1000 bytes each. Assume that the acknowledgement has negligible transmission delay, and that its propagation delay is the same as the data propagation delay. Also assume that the processing delays at the nodes are negligible. The efficiency of the stop-and-wait protocol in this setup is exactly 25%. The value of the one-way propagation delay (*inmilliseconds*) is _____.

(GATE CS 2015)

19) The minimum number of JK flip-flops required to construct a synchronous counter with the count sequence $(0, 0, 1, 1, 2, 2, 3, 3, 0, 0, ...)$ is _____.

(GATE CS 2015)

20) Match the following:

P. Lexical analysis	1. Graph coloring
Q. Parsing	2. DFA minimization
R. Register allocation	3. Post-order traversal
S. Expression evaluation	4. Production tree

(GATE CS 2015)

a) $P-2, Q-3, R-1, S-4$
b) $P-2, Q-1, R-4, S-3$
c) $P-2, Q-4, R-1, S-3$
d) $P-2, Q-3, R-4, S-1$

21) Consider two decision problems Q_1, Q_2 such that Q_1 reduces in polynomial time to 3-SAT and 3-SAT reduces in polynomial time to Q_2. Then which one of following is consistent with the above statement? (GATE CS 2015)

a) Q_1 is in NP, Q_2 in NP hard
b) Q_2 is in NP, Q_1 is NP hard
c) Both Q_1 and Q_2 are in NP
d) Both Q_1 and Q_2 are NP hard

22) A computer system implements a 40-bit virtual address, page size of 8 kilobytes, and a 128-entry translation look-aside buffer (TLB) organized into 32 sets each having four ways. Assume that the TLB tag does not store any process id. The minimum length of the TLB tag in bits is _____.
(GATE CS 2015)

23) Consider the following C function.

```
int fun (int n)
int x = 1, k;
if  (n == 1)  return x};
for  (k = 1; k < n; k++)
x = x + fun(k) * fun(n - k);
return x;
 }
```

The return value of fun (5) is _____
(GATE CS 2015)

24) Consider the following statements
I. The complement of every Turing decidable language is Turing decidable
II. There exists some language which is in NP but is not turing decidable
III. If L is a language in NP, L is turing decidable
Which of the above statements is/are true?
(GATE CS 2015)

a) Only II b) Only III c) Only I and II d) Only I and III

25) The number of divisors of 2100 is _____.
(GATE CS 2015)

Q.No-26-55 Carry Two Marks Each

26) In a connected graph, a bridge is an edge whose removal disconnects a graph. Which one of the following statements is true?
(GATE CS 2015)

a) A tree has no bridges
b) A bridge cannot be part of a simple cycle
c) Every edge of a clique with size ≥ 3 is a bridge ($A clique is any compete subgraph of a graph$)
d) A graph with bridges cannot have a cycle

27) Consider six memory partitions of sizes 200 KB, 400 KB, 600 KB, 500 KB, 300 KB and 250 KB, where KB refers to kilobyte. These partitions need to be allotted to four processes of sizes 357 KB, 210KB, 468 KB and 491 KB in that order. If the best fit algorithm is used, which partitions are NOT allotted to any process?
(GATE CS 2015)

a) 200KB and 300 KB b) 200KB and 250 KB c) 250KB and 300 KB d) 300KB and 400 KB

28) Which one of the following assertions concerning code inspection and code walkthrough is true?
(GATE CS 2015)

a) Code inspection is carried out once the code has been unit tested
b) Code inspection and code walkthrough are synonyms
c) Adherence to coding standards is checked during code inspection

d) Code walkthrough is usually carried out by an independent test team

29) Given below are some algorithms, and some algorithm design paradigms.

(1) Dijkstra's Shortest Path	(i) Divide and Conquer
(2) Floyd-Warshall algorithm to compute all pair shortest path	(ii) Dynamic Programming
(3) Binary search on a sorted array	(iii) Greedy design
(4) Backtracking search on a graph	(iv) Depth-first search
	(v) Breadth-first search

Match the above algorithms on the left to the corresponding design paradigm they follow.

(GATE CS 2015)

a) $1-i, 2-iii, 3-i, 4-v$
b) $1-iii, 2-iii, 3-i, 4-v$
c) $1-iii, 2-ii, 3-i, 4-iv$
d) $1-iii, 2-ii, 3-i, 4-v$

30) Suppose you are provided with the following function declaration in the C programming language
int partition (int a [], int n);
The function treats the first element of a [] as a pivot, and rearranges the array so that all elements less than or equal to the pivot is in the left part of the array, and all elements greater than the pivot is in the right part. In addition, it moves the pivot so that the pivot is the last elements of the left part. The return value is the number of elements in the left part.
The following partially given function in the C programming language is used to find the Kth smallest element in an array a [] of size n using the partition function We assume $k \leq n$.

```
int kth_smallest(int a, int n, int k)
{
 int left_end = partition(a, n);
 if (left_end + 1 == k) {
  return a[left_end];
 }
 if (left_end + 1 > k) {
  return kth_smallest(__________________);
 } else {
  return kth_smallest(__________________________);
 }
}
```

The missing argument lists are respectively

(GATE CS 2015)

a) a, left_end,k and a + left_end + 1, n − left_end − 1, k − left_end − 1
b) a, left_end,k and a, n − left_end − 1, k − left_end − 1
c) a + left_end + 1, n − left_end − 1, k − left_end − 1 and a, left_end, k
d) a, n − left_end − 1, k − left_end − 1 and a, left_end,k

31) Consider a typical disk that rotates at 15000 rotations per minute (*RPM*) and has a transfer rate of 50×10^6 bytes/sec. if the average seek time of the disk is twice the average rotational delay and the controller's transfer time is 10 times the disk transfer time, the average time (*inmilliseconds*) to read or write a 512-byte sector of the disk is _____.

(GATE CS 2015)

32) Let $f(x) = \frac{1}{x^3}$ and A denote the area of the region bounded by $f(x)$ and the X-axis, when x varies from -1 to 1. Which of the following statements is/are TRUE?
(I) f is continuous in $(-1, 1)$
(II) f is not bounded in $(-1, 1)$
(III) A is nonzero and finite

(GATE CS 2015)

a) II only b) III only c) II and III only d) I, II and III

33) Consider the intermediate code given below.

(1) $i = 1$
(2) $j = 1$
(3) $t1 = 5 * i$
(4) $t2 = t1 + j$
(5) $t3 = 4 * t2$
(6) $t4 = t3$
(7) $a[t4] = 1$
(8) $j = j + 1$
(9) if $j \leq 5$ goto 3
(10) $i = i + 1$
(11) if $i \leq 5$ goto 2

The number of nodes and edges in the control-flow-graph constructed for the above code, respectively, are

(GATE CS 2015)

a) 5 and 7 b) 6 and 7 c) 5 and 5 d) 7 and 8

34) The number of min-terms after minimizing the following Boolean expression is _____.
$D' + AB' + A'C + AC'D + A'C'D'$

(GATE CS 2015)

35) The number of onto function (*surjective functions*) from set $X = \{1, 2, 3, 4\}$ to set $Y = \{a, b, c\}$ is _____.

(GATE CS 2015)

36) Consider the alphabet $\Sigma = \{0, 1\}$, the null/empty string ϵ and the sets of strings X_0, X_1, and X_2 generated by the corresponding non-terminals of regular grammar. X_0, X_1, and X_2 are related as follows:

$$X_0 = 1X_1$$
$$X_1 = 0X_1 + 1X_2$$
$$X_2 = 0X_1 + \epsilon$$

Which one of the following choices precisely represents the strings in X_0?

(GATE CS 2015)

a) $1(0 + 10)^*(10)^* + 1$
b) $1(0 + 10)^*(10)^* * 1$
c) $1(0 + 10)^* 1$
d) $1(0 + 10)^* 1 + 11(0 + 10)^* 1$

37) Which of the following languages is/are regular?
$L_1 = \{wxw^R \mid w, x \in \{a, b\}^*$ and $|w| \geq 0, |x| \geq 0, w^R$ is the reverse of string $w\}$
$L_2 = \{a^n b^m \mid m \neq n$ and $m, n \geq 0\}$
$L_3 = \{a^p b^q c^r \mid p, q, r \geq 0\}$

(GATE CS 2015)

a) L_1 and L_3 only b) L_1 only c) L_2 and L_3 only d) L_3 only

38) Consider a processor with byte-addressable memory. Assume that all registers, including Program Counter (PC) and Program Status Word (PSW), are of size 2 bytes. A stack in the main memory is implemented from memory location $(0100)_{16}$ and it grows upward. The stack pointer (SP) points to the top element of the stack. The current value of SP is $(016E)_{16}$. The CALL instruction is of two words, the first word is the op-code and the second word is the starting address of the subroutine. ($oneword = 2bytes$). The CALL instruction is implemented as follows:
- Store the current Vale of PC in the Stack
- Store the value of PSW register in the stack
- Load the starting address of the subroutine in PC

The content of PC just before the fetch of a CALL instruction is $(5FA0)_{16}$. After execution of the CALL instruction, the value of the stack pointer is

(GATE CS 2015)

a) $(016A)_{16}$ b) $(016C)_{16}$ c) $(0170)_{16}$ d) $(0172)_{16}$

39) The number of states in the minimal deterministic finite automaton corresponding to the regular expression $(0 + 1)^*(10)$ is _____

(GATE CS 2015)

40) Host A sends a UDP datagram containing 8880 bytes of user data to host B over an Ethernet LAN. Ethernet frames may carry data up to 1500 bytes ($i.e. MTU = 1500bytes$). Size of UDP header is 8 bytes and size of IP heard is 20 bytes. There is no option field in IP header How many total number of IP fragments will be transmitted and what will be the contents of offset field in the last fragment?

(GATE CS 2015)

a) 6 and 95 b) 6 and 7400 c) 7 and 1110 d) 7 and 8880

41) Consider the following routing table at an IP router:

Network No.	Net Mask	Next Hop
128.96.170.0	255.255.254.0	Interface 0
128.96.168.0	255.255.254.0	Interface 1
128.96.166.0	255.255.254.0	R2
128.96.164.0	255.255.252.0	R3
0.0.0.0	Default	R4

For each IP address in Group I identify the correct choice of the next hop from Group II using the entries from the routing table above.

Group I	Group II
(*i*) 128.96.171.92	(*a*) Interface 0
(*ii*) 128.96.167.151	(*b*) Interface 1
(*iii*) 128.96.163..151	(*c*) R2
(*iv*) 128.96.165.121	(*d*) R3
	(*e*) R4

(GATE CS 2015)

a) $i-a, ii-c, iii-e, iv-d$
b) $i-a, ii-d, iii-b, iv-e$
c) $i-b, ii-c, iii-d, iv-e$
d) $i-b, ii-c, iii-e, iv-d$

42) Consider two relations $R_1(A, B)$ with the tuples $(1.5), (3, 7)$ and $R_2(A, C) = (1, 7), (4, 9)$. Assume that $R(A, B, C)$ is the full natural outer join of R_1 and R_2. Consider the following tuples of the form (A, B, C): $a = (1.5, \text{null})$, $b = (1, \text{null}, 7)$, $c = (3, \text{null}, 9)$, $d = (4, 7, \text{null})$, $e = (1, 5, 7)$, $f = (3, 7, \text{null})$, $g = (4, \text{null}, 9)$.
Which one of the following statements is correct?

(GATE CS 2015)

a) R contains a, b, e, f, g but not c, d.
b) R contains all of a, b, c, d, e, f, g
c) R contains e, f, g but not a, b
d) R contains e but not f, g

43) Consider a simple check pointing protocol and the following set of operations in the log.
(Start, T_4) ; (write, $T_4, y, 2, 3$) ; (Start, T_1) ; (commit, T_4) ; (write, $T_1, z, 5, 7$) ;
(checkpoint) ;
(Start, T_2) ; (write, $T_2, x, 1, 9$) ; (commit, T_2) ; (start, T_3) , (write, $T_3, z, 7, 2$) ;
If a crash happens now and the system tries to recover using both undo and redo operations, what are the contents of the undo lists and the redo list?

(GATE CS 2015)

a) Undo: T_3, T_1; Redo: T_2
b) Undo: T_3, T_1; Redo: T_2, T_4
c) Undo: none; redo: T_2, T_4, T_3, T_1
d) Undo: T_3, T_1, T_4; Redo: T_2

44) A computer system implements 8 kilobyte pages and a +32-bit physical address space. Each page table entry contains a valid bit, a dirty bit, three permission bits, and the translation. If the maximum size of the page table of a process is 24 megabytes, the length of the virtual address supported by the system is _____ bits.

(GATE CS 2015)

45) Which one of the following hash functions on integers will distribute keys most uniformly over 10 buckets numbered 0 to 9 for i ranging from 0 to 2020?

(GATE CS 2015)

a) $h(i) = i^2 \bmod 10$
b) $h(i) = i^3 \bmod 10$
c) $h(i) = (11 * i)^2 \bmod 10$
d) $h(i) = (12 * i) \bmod 10$

46) Assume that the bandwidth for a TCP connection is 1048560 bits/sec. Let α be the value of RTT in milliseconds. ($roundedoffothenearestinteger$) after which the TCP window scale option is needed. Let β be the maximum possible window size the window scale option. Then the values of α and β are

(GATE CS 2015)

a) $\alpha = 63$ milliseconds, $\beta = 65535 \times 2^{14}$
b) $\alpha = 63$ milliseconds, $\beta = 65535 \times 2^{16}$
c) $\alpha = 500$ milliseconds, $\beta = 65535 \times 2^{14}$
d) $\alpha = 500$ milliseconds, $\beta = 65535 \times 2^{16}$

47) A young tableau is a 2D array of integers increasing from left to right and from top to bottom. Any unfilled entries are marked with ∞, and hence there cannot be any entry to the right of ∞, or below a ∞.
The following Young tableau consists of unique entries.

1	2	5	14
3	4	6	23
10	12	18	25
31	∞	∞	∞

When an element is removed from a Young tableau, other elements should be moved into its place so that the resulting table is still a Young tableau ($unfilledentriesmaybefilledinwitha\infty$). The minimum number of entries ($otherthan1$) to be shifted, to remove 1 from the given Young tableau is _____

(GATE CS 2015)

48) A half adder is implemented with XOR and AND gates. A full adder is implemented with two half adders and one OR gate. The propagation delay of an XOR gate is twice that of an AND/OR gate. The propagation delay of an AND/OR gate is 1.2 microseconds. A 4-bit ripple-carry binary adder is implemented by using four full adders. The total propagation time of this 4-bit binary adder in microseconds is _____.

(GATE CS 2015)

49) Consider the sequence of machine instruction given below:
MUL R_5, R_0, R_1
DIV R_6, R_2, R_3
ADD R_7, R_5, R_6
SUB R_8, R_7, R_4
In the above sequence, R_0 to R_8 are general purpose registers. In the instructions shown. the first register stores the result of the operation performed on the second and the third registers. This sequence of instructions is to be executed in a pipelined instruction processor with the following 4 stages (1) Instruction Fetch and Decode (IF), (2) Operand Fetch (OF), (3) Perform Operation (PO) and (4) Write back the result (WB) . The IF,OF and WB stages take 1 clock cycle each for any instruction The PO stage takes 1 clock cycle for ADD or SUB instruction, 3 clock cycles for MUL instruction and 5 clock cycles for DIV instruction. The pipelined processor uses operand forwarding from the PO stage to the OF stage. The number of clock cycles taken for the execution of the above sequence of instructions is _____.

(GATE CS 2015)

50) Perform the following operations on the matrix $\begin{pmatrix} 3 & 4 & 45 \\ 7 & 9 & 105 \\ 13 & 2 & 195 \end{pmatrix}$.
(i) Add the third row to the second row
(ii) Subtract the third column from the first column.
The determinant of the resultant matrix is _____.

(GATE CS 2015)

51) Which one of the following well formed formulae is a tautology?

(GATE CS 2015)

a) $\forall x \exists y R(x, y) \rightarrow \exists y \forall x R(x, y)$
b) $(\forall x \exists y (R(x, y) \rightarrow S(x, y))) \rightarrow (\forall x \exists y S(x, y))$
c) $(\forall x \exists y (p(x, y) \rightarrow R(x, y))) \rightarrow (\forall x \exists y (P(x, y)) \rightarrow \forall x \exists y R(x, y))$
d) $\forall x \exists y p(x, y) \leftrightarrow \forall x \exists y p(y, x)$

52) A graph is self-complementary if it is isomorphic to its complement For all self-complementary graphs on n vertices, n is

(GATE CS 2015)

a) A multiple of 4
b) Even
c) Odd
d) Congruent to 0 mod 4, or, 1 mod 4

53) The secant method is used to find the root of an equation $f(x) = 0$. It is started from two distinct estimates, x_a and x_b for the root. It is an iterative procedure involving linear interpolation to a root. The iteration stops if $f(x_b)$ is very small and then x_b is the solution. The procedure is given below. Observe that there is an expression which is missing and is marked by ? Which is the suitable expression that is to be put in place of ? so that it follows all steps of the secant method?

```
Secant
Initialize: xa, xb, e, N        // e = convergence indicator
// N = maximum no. of iterations
fb = f(xb)
i = 0
while (i < N and |fb| > e) do
i = i + 1               // update counter
xt = ?                  // missing expression for xt
xa = xb                 // reset xa
xb = xt                 // reset xb
fb = f(xb)              // function value at new xb
end while

if |fb| >= e then
write "Non-convergence"     // loop terminated with i = N
else
write "return xb"
End if
```

(GATE CS 2015)

a) $x_b - \frac{f_b(x_b - x_a)}{f_b - f_a}$
b) $x_a - \frac{f_a(x_a - x_b)}{f_a - f_b}$
c) $x_b - \frac{(x_b - x_a)}{f_b - f_a} \times f_b$
d) $x_a - \frac{(x_a - x_b)}{f_a - f_b} \times f_a$

54) Let X and Y denote the sets containing 2and 20 distinct objects respectively and F denote the set of all possible functions defined from X to Y. let f be randomly chosen from F .The probability of f being one-to-one is _____.

(GATE CS 2015)

55) Consider the C program below.

```
#include <stdio.h>
int *A, stkTop;
int stkFunc(int opcode, int val)
{
 static int size = 0, stkTop = 0;
 switch (opcode)
 {
  case -1 : size = val; break;
  case 0  : if (stkTop < size) A[stkTop++] = val; break;
  default : if (stkTop) return A[--stkTop];
 }
 return -1;
}
```

```
int main()
{
 int B[20];
 A = B;
 stkTop = -1;

 stkFunc(-1, 10);
 stkFunc(0, 5);
 stkFunc(0, 10);

 printf("%d\n", stkFunc(1, 0) + stkFunc(1, 0));
}
```

The value printed by the above program is _____.

(GATE CS 2015)