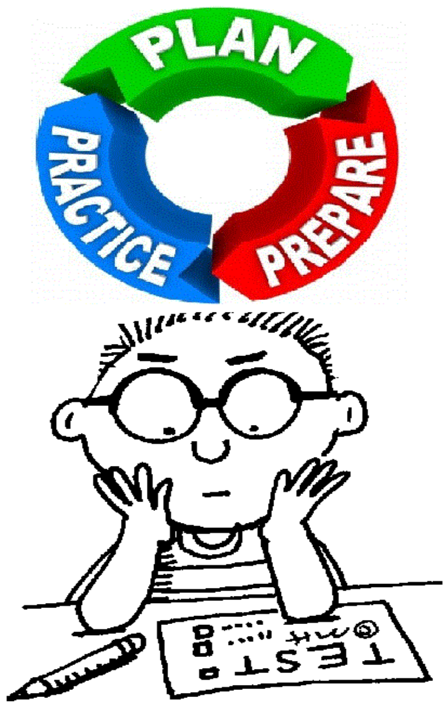
GATE INSTRUCTORS

GATE 2015

COMPUTER SCIENCE / IT
Gate Practice Test booklet



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Contents

Gate Practice Test No. 1

All questions carry 1 marks each.

Q. 1. Given: $Pr(C|D) = 0.2$ and $Pr(D|C) = 0.06$. What is $Pr(C)$ and $Pr(D)$?
(1) 0.2, 0.06 (2) 0.30, 0.70 (3) 0.06, 0.2 (4) None of above

Q. 2. Which of the following is tautology?
(1) $x \cup y \to y \cap z$ (2) $x \cap y \to y \cup z$
(3) $x \cup y \to (y \to z)$ (4) $x \to y \to (y \to z)$

Q. 3. Suppose $A = \{\}, B = \{1, 2, 3\}$. What does the set $B \times A$ contain?
(1) $\{\ \}$ (2) $\{1, 2, 3\}$
(3) $\{(1), (2), (3)\}$ (4) None of the above

Q. 4. Which of the following statement is not correct?
(1) Continuity is a necessary and sufficient condition for differentiability
(2) Differentiability is sufficient condition for continuity
(3) Continuity is a necessary condition for differentiability
(4) Existent of $\lim_{\delta x \to 0} \frac{f(x+\delta x)-f(x)}{\delta x}$ is a necessary and sufficient condition for differentiability

Q. 5. The number -45 in 2's complement representation is:
(1) 0010 1101 (2) 1101 0011
(3) 0001 0010 (4) 0010 1110

Q. 6. A Latch remembered previous output as 1. With S=1 and R=0, what is value of Q?
(1) 1 (2) 0 (3) 1 or 0 (4) None of the above

Q. 7. How many select lines does 1:16 multiplexer have?
(1) 1 (2) 4 (3) 5 (4) 16

Q. 8. Software interrupts are useful to processor to
(1) test processor interrupts system
(2) implement co-routines
(3) obtain system service which need execution of privilege instructions
(4) return from subroutine

Q. 9. Which of the following identities are correct?
(1) $rs^* = rss^*$ (2) $(r^*s^*) = (r + s)^*$
(3) $(r + s)^* = r^* + s^*$ (4) $(r^*s^*)^* = (r + s)^*$

Q. 10. Let L_1 and L_2 are regular sets defined over alphabet Σ^*. Mark the false statement.
(1) $L_1 \cup L_2$ is regular (2) $L_1 \cap L_2$ is not regular
(3) $\Sigma^* - L_1$ is regular (4) L_1^* is regular

Q. 11. Suppose A and B are two sets of strings from Σ^*. Further suppose that B is a subset of A. Which of the following statement must always be true for A and B.
I. If A is finite then B is finite
II. If A is regular then B is regular
III. If A is context free then B is context free
(1) I only (2) II only (3) III only (4) All three

Q. 12. Minimum number of edges in a connected cyclic graph on n-nodes is
(1) $log_2 n$ (2) $n - 1$ (3) n (4) $n + 1$

Q. 13. Tree Sort is:
(1) Insertion of n values in a tree and then pre-order
(2) Insertion of n values in a binary search tree and then in-order
(3) Insertion of n values in a binary search tree and then pre-order
(4) None of the above

Q. 14. Prim's Algorithm can be improved by
(1) Heap (2) Binomial Heap
(3) Fibonacci Heap (4) Priority Queues

Q. 15. What is the worse case and best case complexity of bubble sort?
(1) $O(n^2)$ and $O(log\ n)$ (2) $O(n^2)$ and $O(n\ log\ n)$
(3) $O(n^2)$ and $O(n)$ (4) $O(n\ log\ n)$ and $O(log\ n)$

Q. 16. Number of edges of a complete binary tree with 16 leaf nodes is
(1) 14 (2) 30 (3) 32 (4) 28

Q. 17. Which data structure can be used for checking palindrome
(1) Queue (2) Singly Linked List
(3) Stack (4) Doubly Linked List

Q. 18. In compilers, the type checking is done in:
(1) Lexical Analysis (2) Semantic Analysis
(3) Code Generation phase (4) None of the above

Q. 19. What is time and space complexity for determining $x \in L(r)$ with DFA?
(1) Space complexity $O(x)$ and time complexity $O(|\ r\ |)$
(2) Space complexity $O(r)$ and time complexity $O(|\ r\ | * |\ x\ |)$
(3) Space complexity $O(2^{|r|})$ and time complexity $O(|\ x\ |)$
(4) Space and time complexity both $O(|\ r\ |)$

Q. 20. Which grammar causes recursive-descent parser to go into infinite loop?
(1) LL(1) (2) Left recursive grammar
(3) Right recursive grammar (4) Grammar with left factors

Q. 21. Consider a situation, in which several people are executing copies of the mail program, which of the following statements are not correct:
I. All the users share one program counter and stack for mail program.
II. All the users share the same execution sequence.
III. All the users share same text section, but data section varies necessarily.
(1) I and II (2) only I (3) only II (4) only III

Q. 22. A computer system has 6 tape drives with n process competing for them. Each process may need up-to 2 tape drives. The maximum value of n from which the system is guaranteed to be deadlock free is:
(1) 2 (2) 3 (3) 4 (4) 1

Q. 23. Consider a logical address space of eight pages of 1024 words each mapped onto a physical memory of 32 frames. How many bits are there in the logical address?
(1) 13 (2) 15 (3) 23 (4) 14

Q. 24. Which of the following languages will be equivalent:

$$
\begin{aligned}
L_1 &= \{0^n 1^n; n \geq 1\} \\
L_2 &= S \rightarrow 0S1 \mid 01 \\
L_3 &= 01 \mid 0^+011^+
\end{aligned}
$$

(1) L_1 and L_2 (2) L_1 and L_2
(3) L_2 and L_3 (4) L_1, L_2 and L_3

Q. 25. A graph has n nodes and k components. A node with two edges, connecting two separate components is added. Number of components in the new graph will be:

(1) $k+1$ (2) k (3) $k-1$ (4) $k-2$

All questions carry 2 marks each.

Q. 26. Locality of reference implies that the page reference made by a process
(1) will always be the page used in previous page
(2) is likely to be one of the pages used in the last
(3) will always be one of the pages in memory
(4) will always save you from page fault

Q. 27. Is the natural left outer join operation associative?
(1) Yes (2) No
(3) Depends on the relations (4) None of the above.

Q. 28. When doing merge-join, the preferred buffer management algorithm is
(1) LRU (2) FCFS (3) MRU (4) None of the above

Q. 29. Quality of Service (QoS) is related with
(1) Transport Layer (2) Application Layer
(3) Network Layer (4) Physical Layer

Q. 30. In CRC, what is CRC?
(1) divisor (2) quotient (3) dividend (4) remainder

Q. 31.
I. An SQL query automatically eliminates duplicates
II. An SQL query will not work if there are no indexes on the relations
III. SQL permits attribute names to be repeated in the same relation
Which of the above are true?
(1) I only (2) II only
(3) III only (4) I and II only

Q. 32. Cost of joining 3 relations is —— than joining 4 relations
(1) greater (2) always smaller
(3) sometimes smaller (4) never smaller

Q. 33. There are pencils in the box: 10 red ones, 8 blue, 8 green, 4 yellow. Let us take, with eyes closed, some number of pencils from the box. What is the least number of pencils we have to take in order to ensure that we get at least 4 pencils of the same color?
(1) 4 (2) 16 (3) 12 (4) 13

Q. 34. Consider a binary relation R shown in the following matrix on set $S = \{1, 2, 3, 4\}$.

$$R = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

The relation R is:
(1) Equivalence relation
(2) irreflexive and antisymmetric
(3) irreflexive, symmetric and transitive
(4) transitive but neither reflexive nor irreflexive

Q. 35. What could we say about the following system of linear equations?

$$
\begin{aligned}
x_2 - 4x_3 &= 8 \\
2x_1 - 3x_2 + 2x_3 &= 1 \\
5x_1 - 8x_2 + 7x_3 &= 1
\end{aligned}
$$

(1) The system is consistent with a unique solution
(2) The system is consistent
(3) The system is inconsistent
(4) None of the above

Q. 36. How many iterations are required to find the smallest positive roots of the following equation by secant method

$$f(x) = x^3 - 3x^2 + x + 1$$

with initial guesses of 0 and 1.5.
(1) 3 (2) 2 (3) 5 (4) 7

Q. 37. A cylindrical container with a circular base and an open top is hold to 64 cm^3. Find its dimensions so that the surface area is minimized.
(1) Radius=4 and Height= $4/\pi^{(1/2)}$
(2) Radius and Height = 4
(3) Radius and Height = 8
(4) Radius and Height = $4/\pi^{(1/3)}$

Q. 38. Fig. (1.1) shows relation on set $S = \{2, 3, 6, 8\}$. The relation is
(1) Equivalence Relation
(2) Poset
(3) Symmetric and Reflexive relation
(4) None of the above

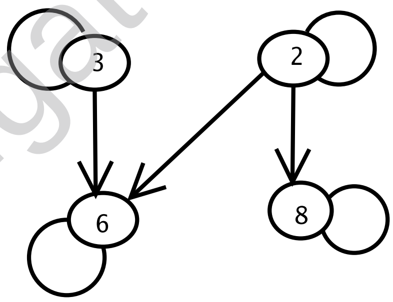

Figure 1: Fig. for Q. 38

Q. 39. While transmitting binary digits through a communication channel, the number of digits received correctly, Cn out of n transmitted digits has a binomial distribution $b(k; n, p)$. Find out the probability of error free transmission.
(1) $p^{(n-1)}$ (2) p^n (3) p^0 (4) None of the above

Q. 40. What is the baud rate for standard 10 Mbps Ethernet link?
(1) 100 MBaud (2) 200 MBaud (3) 10 MBaud (4) 20 MBaud

Q. 41. Q: Which of the following is part of congestion prevention policies at network layer
(1) Out-of-order caching policy
(2) Retransmission policy
(3) Acknowledgment policy
(4) Routing Algorithm

Q. 42. Q: What is the subnetwork address for IP:213.23.47.37 and Mask: 255.255.255.240

(1) 213.23.47.16 (2) 213.23.47.32
(3) 213.23.48.32 (4) 213.23.47.48

Q. 43. According to IEEE standard, a 32 bit single precision floating point number N is defined as

$$N = (-1)^s \times 1.F \times 2^{(E-127)}$$

S is sign bit, F is fractional mantissa, and E is biased exponent. S uses 1 bit, F uses 8 bits, and E uses 23 bits. What will be decimal value of the floating point number defined in above format as $C1E00000$.
(1) 26 (2) -15 (3) -26 (4) -28

Q. 44. Match the pairs about implementation and addressing modes:

Group A	**Group B**
A. Array	I. Indirect Addressing
B. Relocatable code	II. Indexed Addressing
C. Array as parameter	III. Base Register Addressing

(1) (A-II), (B-III), (C-I)
(2) (A-III), (B-I), (C-II)
(3) (A-III), (B-II), (C-I)
(4) (A-I), (B-III), (C-II)

Q. 45. Consider the following K-Map

	BC			
A	1	0	1	0
	0	1	0	1

Which of the following is not equation of the system?
(1) $A \odot B \oplus C$
(2) $A \oplus B \oplus C$
(3) $A'B'C' + AB'C + A'BC + ABC$
(4) $A \oplus B \odot C$

Q. 46. A complete binary tree can be stored in array. Then to access child of ith node, – th and – th index of array needs to be used.(index starts at 1)
(1) $2i-1,\ 2i$ (2) $2i,\ 2i+1$
(3) $2i+1,\ 2i+2$ (4) $2i-1,\ 2i+1$

Q. 47. Consider the grammar,

$$\begin{aligned} S &\rightarrow PQ \mid SQ \mid PS \\ P &\rightarrow x \\ Q &\rightarrow y \end{aligned}$$

To get a set of n terminals, the number of productions to be used are
(1) n^2 (2) $n+1$ (3) $2n$ (4) $2n-1$

Q. 48. Consider a DFA accepting all strings over $\{a, b\}$ such that number of a's and b's are even. What is the minimum number of states such DFA will have?
(1) 4 (2) 2 (3) 6 (4) 8

Q. 49. Which of the following languages are context free:

$$\begin{aligned} L_1 &= a^i b^i c^j \mid i \geq 1 \ and \ j \geq 1 \\ L_2 &= a^i b^i c^j \mid j \geq i \\ L_3 &= a^i b^i c^i \mid i \geq 1 \end{aligned}$$

(1) Only L_1 (2) L_2 and L_3
(3) Only L_2 (4) Only L_3

Q. 50. Which of the following functions are computable with Turing machine?
(1) $n*(n-1)*(n-2)\ldots*2*1$
(2) $\lceil log_2\ n\rceil$
(3) 2^{2^n}
(4) None of the above

Q. 51. Consider the grammar

$$\begin{aligned} S &\rightarrow A \\ A &\rightarrow BA \mid \epsilon \\ B &\rightarrow aB \mid b \end{aligned}$$

The grammar is
(1) LALR (2) LR(0) (3) LR(1) (4) None of the above

Q. 52. Consider

$$\begin{aligned} L_1 &= O^n1^n \\ L_2 &= 0^nc1^n \end{aligned}$$

Which of the following statements are correct:
I. L_1 and L_2 are accepted by non-deterministic PDA.
II. L_1 and L_2 are accepted by deterministic PDA.
III. Only L_2 is accepted by deterministic PDA
(1) Only I (2) I and II
(3) I and III (4) All three

Q. 53. How many height balanced trees with 5 nodes are possible?
(1) 3 (2) 4 (3) 5 (4) 6

Q. 54. Consider a knapsack problem with

$$\begin{aligned} n &= 3, m = 20, \\ (p1, p2, p3) &= (25, 24, 15), \text{and} \\ (w1, w2, w3) &= (18, 15, 10) \end{aligned}$$

Which is the optimal solution for $(x1, x2, x3)$:
(1) 1/2, 1/3, 1/4
(2) 1, 2/15, 0
(3) 0, 2/3, 1
(4) 0, 1, 1/2

Q. 55. Given array representation of a heap, does that represent a min-heap

I:	0	2	4	7	5	5	6
II:	5	7	8	6	9	9	10

(1) I only (2) II only
(3) I and II both (4) None

Q. 56. If the following function is to find GCD recursively, fill in the blank:

```
int GCD(int a, int b) {
    if( b == 0 )   return a;
    else   return GCD(b, ...);
}
```

(1) a/b (2) b/a (3) $b\%a$ (4) $a\%b$

Q. 57. Consider

$$T_1(n) = T_1(n/3) + T_1(2n/3) + n.$$
$$T_2(n) = 3T_2(n/4) + n$$

Which of the following statement is not incorrect?
(1) T_1 has faster order growth than T_2
(2) T_2 has faster order growth than T_1
(3) T_1 and T_2 has same order growth
(4) None of the above

Q. 58. The recurrence relation below is

$$T(n) = 2T(n/2) + n^2$$
$$T(1) = 1$$

(1) $O(n^3)$ (2) $O(n^2)$ (3) $O(n)$ (4) $O(n\ log\ n)$

Q. 59. Find the weight of the following spanning tree:
(1) 35 (2) 37 (3) 32 (4) 39

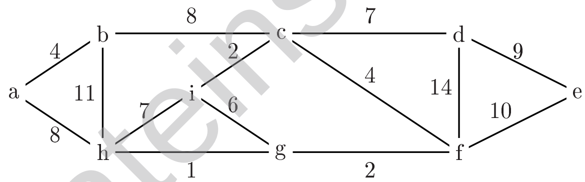

Figure 2: Fig. for Q. 59

Q. 60. What is the post-order traversal of a tree whose pre-order and in-order are:

PRE: ABDEHICFGJK
IN : DBHEIAFCJGK

(1) DIHBEFKJCGA (2) DHIBEFKJCGA
(3) DHIEBFJKGCA (4) DHBIEFJKCGA

Q. 61. Given pointer to a node which is to be deleted, what is the time complexity of deletion of that node in a circular linked list? (n is no. of nodes in the list).
(1) $O(n)$ (2) $O(log\ n)$ (3) $O(1)$ (4) $O(n^2)$

Q. 62. What is the number of edges in a graph if degree of each node is ≥ 4 and ≤ 6. Thus the number of nodes will be
(1) $> 4n$ and $< 6n$ (2) $> 2n$ and $< 3n$
(3) $\geq 2n$ and $\leq 3n$ (4) $> 2(n-1)$ and $< 3(n-1)$

Q. 63. In a box there are random number of white and black marbles. At a time two marbles are taken out at random and if
A. Both Black: Discard both and insert a white
B. Both White: Discard one and retain one
C. One Black and One White: Discard White and retain Black.
If initially there are n_b black and n_w white marbles then determine the color of the only marble remaining at the end.
(1) white if n_b is even (2) white if n_w is odd
(3) black if n_b is even (4) black if n_w is odd

Q. 64. A 8-queens problem is example of

(1) Dynamic Programming (2) Backtracking
(3) Greedy (4) None of the above

Q. 65. How many tokens will be generated from the following C statement:

```
if(x > 10)    y ++;
else   y --;
```

(1) 13 (2) 8 (3) 11 (4) 9

Q. 66. Consider the following two parse trees for the expression: 9 - 5 - 2.

```
         list                     list
        / |  \                   /  | \
       /  |   \                 /   |  \
     list  -   digit        digit  -  list
     / | \       |            |       / | \
    /  |  \      |            |      /  |  \
list   -  digit  2            9   digit -  list
 |          |                       |        |
 |          |                       |        |
digit       5                       5      digit2
 |                                           |
 |                                           |
 9                                           2
  (a)                        (b)
```

Consider the following statements:

1. The parse tree (a) represents right associative operator evaluation and that of (b) represents left associative evaluation.
2. The grammar generating the sentence is not ambiguous.

Which of the above statements are false?
(1) Only 2 (2) 1 and 2
(3) Only 1 (4) Both the statements are correct.

Q. 67. Consider the following production rules and their syntax directed definition:

Production	Semantic Rule
$expr \rightarrow expr1 + term$	$expr.t := expr1.t \| \| term.t \| \| '+'$
$expr \rightarrow expr1 - term$	$expr.t := expr1.t \| \| term.t \| \| '' - ''$
$expr \rightarrow term$	$expr.t := term.t$
$term \rightarrow 0$	$term.t :=' 0'$
$term \rightarrow 1$	$term.t :=' 1'$
$\ldots$	$\ldots$
$term \rightarrow 9$	$term.t :=' 9'$

What will be the translation of expression: $8 - 5 + 2$?
(1) 8-5+2 (2) 852-+
(3) -+852 (4) 85-2+

Q. 68. Consider the following activation tree in Fig.(1.3). How many elements will be present on the stack after completion of execution of p(1,0)?
(1) 3 (2) 6 (3) 5 (4) 4

Q. 69. Let A be a 10×20 array. What will be the height of annotated parse tree for the assign-

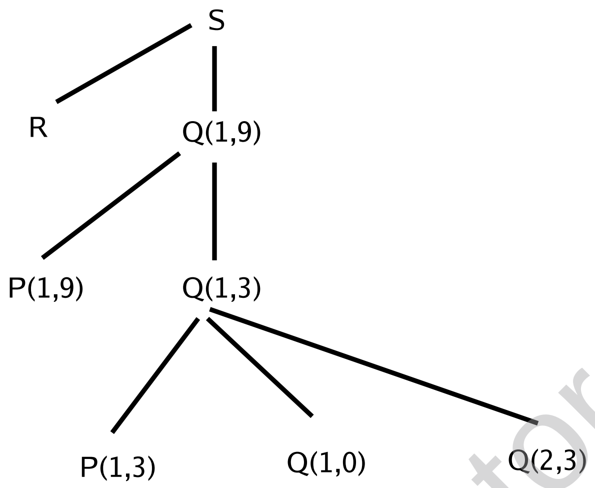

Figure 3: Fig. for Q. 68

ment: $x := A[y, z]$. The grammar is as follows:

$$\begin{array}{rcl} S & \rightarrow & L := E \\ E & \rightarrow & L \\ L & \rightarrow & id \\ L & \rightarrow & E_{list}] \\ E_{list} & \rightarrow & E_{list}, E \\ E_{list} & \rightarrow & id[E \end{array}$$

(1) 7 (2) 6 (3) 9 (4) 11

Q. 70. Consider the following grammar

$$\begin{array}{rcl} E & \rightarrow & E + T \mid T \\ T & \rightarrow & T * F \mid F \\ F & \rightarrow & (E) \mid id \end{array}$$

Write the productions for E, T and F after converting this grammar to LL(1) grammar.
(1) $E \rightarrow +TE',\ T \rightarrow *FT',\ F \rightarrow (E)|id$
(2) $E \rightarrow +TE'| \in,\ T \rightarrow *FT'| \in$
(3) $E \rightarrow T,\ T \rightarrow F,\ F \rightarrow (E)|id$
(4) $E \rightarrow TE',\ T \rightarrow FT',\ F \rightarrow (E)|id$

Q. 71. Arrange the following systems in ascending order in terms of CPU utilization:
1. Hands-on computer system
2. Batch System
3. Batch System with Spooling
4. Batch System with similar jobs executed together
(1) 1,3,4,2 (2) 3,2,4,1 (3) 2,4,3,1 (4) 4,2,3,1

Q. 72. Consider the following set of processes that arrive at time 0 in the order P_1, P_2, P_3, and P_4 and the length of their CPU burst is given below:

Process	Burst Time
P_1	5
P_2	4
P_3	6
P_4	3

Further suppose that we're interested in running the processes in FCFS or Round Robin scheduling with time quantum of 6. Which of the following holds true in the situation:
(1) FCFS out performs Round robin scheduling
(2) Round robin performs better than FCFS
(3) Both yield exactly the same performance
(4) None of the above.

Q. 73. Consider a system with five processes P_0 to P_4 and three resources R_1, R_2 and R_3, each having 10, 5, 7 instances respectively. The system snapshot at time T_0 is shown below:

	Allocation			Max			Available		
	R_1	R_2	R_3	R_1	R_2	R_3	R_1	R_2	R_3
P_0	0	1	0	7	5	3	3	3	2
P_1	2	0	0	3	2	2			
P_2	3	0	2	9	0	2			
P_3	2	1	1	2	2	2			
P_4	0	0	2	4	3	3			

Which of the following execution sequence ensures safety in the system?
(1) P_1, P_3, P_4, P_2, P_0
(2) P_1, P_4, P_2, P_3, P_0
(3) P_3, P_1, P_2, P_4, P_0
(4) P_4, P_2, P_3, P_0

Q. 74. Consider a paging system with the page table in memory. Each memory reference takes 200 ns. The TLB has hit ratio of 75% and the time to look for pages in TLB is almost negligible. What is the effective paged memory reference take?
(1) 400 (2) 250 (3) 150 (4) 200

Q. 75. In a system with 62 frames there are two processes running, P_1 of size 10k and P_2 of size 127k. How many frames will be allocated to each of the processes by proportional allocation scheme?
(1) 31 frames each to P_1 and P_2
(2) 4 frames to P_1 and 57 frames to P_2
(3) 2 frames to P_1 and 60 frames to P_2
(4) None of the above

Q. 76.

```
void abc(char *s) {
    if( s[0] == '\0')   return;
    abc(s+1);
    abc(s+1);
    printf("%c",s[0]);
}
main() {
    abc("123");
}
```

What is the output of the program:
(1) 3 3 2 1 3 2 1
(2) 3 2 3 1 3 2 1
(3) 3 3 2 3 3 2 1
(4) 3 3 3 1 3 3 2

Q. 77.

```
int f(int num) {
    int bits=0;
    while( num ) {
        num &= (num -1);
        ++bits ;
    }
    return bits;
}

int main(void) {
    printf("%d",f(11));
}
```

(1) 2 (2) 3 (3) 4 (4) 5

Q. 78. Consider a program in a language with C like syntax but do not assume the C language semantics: What will be the value of x, y, and k after execution:

```
x=5, y = 6;
k = 0;
while( x != 0 ) {
    if( --x && y-- )  k++;
}
```

(1) 024 (2) 013
(3) 014 (4) 023

Q. 79. Union is not recommended in C because
(1) It saves memory but memory is very cheap now a days
(2) It unnecessarily complicates the program
(3) One type of data can be accessed as other type which
(4) None of the above

Q. 80. How many times `fib(3)` is called during invocation of `fib(6)` ?

```
fib(x) = fib(x-1) + fib(x-2)
fib(0) = 1
fib(1) = 1
```

(1) 3 (2) 4 (3) 5 (4) 6

Q.81-90 are in the set of two each. We have not implemented dependency of 81b on 81a so that you can get correct answers for both. But in exam, you will be evaluated on dependency basis

Information pertains to Q. 81 - 82

Analysis of the daily registrations at GateGenie on a certain day indicated that the source of registrations from North India are 15%, South India are 35% and that from Western part of India are 50%. Further suppose that the probabilities that a registration being a free registration from these parts are 0.01, 0.05 and 0.02, respectively.

Q. 81. Find the probability that a registration chosen at random is a free-registration.
(1) 0.603 (2) 0.029 (3) 0.009 (4) None of the above

Q. 82. Find the probability that a randomly chosen registration comes from South India, given that its a free registration.
(1) 60% (2) 3% (3) 17% (4) None of the above

Information pertains to Q. 83 - 84

Array $S1$ contains 256 elements 4 bytes each. Its first element is stored at physical address 4096. Array $S2$ contains 512 elements 4 bytes each stored from physical address location 8192. Assume that only arrays $S1$ and $S2$ can be cached in an initially empty, physically addressed, physically tagged, direct mapped 2kb cache with 8 byte block size.

Q. 83. The following loop is then executed:

```
for( i=0; i<256; i++) {
    A[i] = A[i] + B[2*i]
}
```

During the execution of loop, how many bytes will be written to memory if the cache has write through policy?
(1) 0 (2) 256 (3) 1024 (4) 2048

Q. 84. If the cache has write back policy, how many bytes will be written to memory during execution of loop?
(1) 0 (2) 256 (3) 1024 (4) 2048

Information pertains to Q. 85 - 86

Let $X = \{1, 2, 3, 4\}$. If
$R = \{< x, y > \mid x \in X \; ; y \in X \; ; (x - y) > 0 \; ; (x - y)\%2 = 0\}$
$S = \{< x, y > \mid x \in X \; ; y \in X \; ; (x - y) > 0 \; ; (x - y)\%3 = 0\}$
Q. 85. Find $|R \cup S|$ and $|R \cap S|$.
(1) $|R \cup S| = 6$, $|R \cap S| = 0$
(2) $|R \cup S| = 3$, $|R \cap S| = 6$
(3) $|R \cup S| = 2$, $|R \cap S| = 2$
(4) $|R \cup S| = 5$, $|R \cap S| = 3$

Q. 86. If $X = \{1, 2, 3, \ldots\}$, what is $R \cap S$?
(1) $R = \{< x, y > \mid x \in X \; ; y \in X \; ; (x - y) > 0 \; ;$
$(x - y)\%2 = 0 \; or \; (x - y)\%3 = 0 \; \}$
(2) $R = \{< x, y > \mid x \in X \; ; y \in X \; ; (x - y) > 0 \; ; (x - y)\%6 = 0\}$
(3) $R = \{< x, y > \mid x \in X \; ; y \in X \; ; (x - y) > 0 \; ; (x - y)\%5 = 0\}$
(4) None of the above

Information pertains to Q. 87 - 88

Q. 87. What will be the array representation of a max-heap with insertions:

$$40, 80, 35, 90, 45, 50, 70$$

(1) 90 80 70 40 45 35 50
(2) 90 80 70 45 40 50 35
(3) 90 70 80 40 45 35 50
(4) 90 70 80 45 40 50 35

Q. 88. If 100 is added to the heap above,what will be the new array representation
(1) 90 80 70 40 45 35 50 100
(2) 100 90 70 80 45 35 50 40
(3) 100 90 80 70 40 45 35 50
(4) 100 80 90 70 40 45 35 50

Information pertains to Q. 89 - 90

Consider the following relational database

```
Student(ID, name, dept-no, hostel-no, ...) PK:ID
Department(dept-no, name, ... ) PK:dept-no
Hostel(hostel-no, warden-name, ... ) PK:hostel-no
```

Q. 89. What does following query gives:

```
select h.hostel-no, d.dept-no, count(*)
from Hostel h, Department d, Student s
where s.dept-no = d.dept-no
and s.hostel-no = h.hostel-no
order by h.hostel-no
group by h.hostel-no, d.dept-no;
```

(1) Number of students per dept. for each hostel
(2) Number of students in all hostels for each dept.
(3) Number of students per hostel in each dept.
(4) None of the above

Q. 90. Write a query to print `hostel-no` in which there is no student from `department` name **CSE**.

(1)
```
select h.hostel-no from Hostel h
where h.hostel-no
IN (select distinct h.hostel-no
from Hostel h, Department d, Student s
where h.hostel-no = s.hostel-no
and s.dept-no = d.dept-no
and d.name = 'CSE' );
```

(2)
```
select h.hostel-no from Hostel h
where h.hostel-no
NOT IN ( select distinct h.hostel-no
from Hostel h, Department d, Student s
where h.hostel-no=s.hostel-no
and s.dept-no=d.dept-no
and d.name='CSE' );
```

(3)
```
select h.hostel-no from Hostel h
where h.hostel-no
NOT IN ( select distinct h.hostel-no
from Hostel h, Department d, Student s
where h.hostel-no=s.hostel-no
and s.dept-no=d.dept-no
and d.name <> 'CSE');
```

(4)
```
select h.hostel-no from Hostel h
where h.hostel-no IN
(select distinct h.hostel-no
from Hostel h, Department d, Student s
where h.hostel-no=s.hostel-no
and s.dept-no=d.dept-no
and d.name <> 'CSE' );
```