IITB CSE PhD Admission Test 2009*

General Aptitude

Q1 An institute has been charged for showing bias against women in their admission procedure. The statistics are as follows:

Sex	No applied	% Admitted
Men	1000	49%
Women	400	27.5%

Suppose you have two departments X and Y. Give a situation where the percentage of acceptance rate of women is more than that of men in both the departments, but the overall data matches with the table given above.

Q2 In how many ways can one write numbers from 1 to n such that every element is either lesser than or greater than all the preceding numbers.

Q3 Suppose you have a valid sudoku grid S. In how many ways can you permute the columns of S such that the resulting grid is also valid.

Q4 A set of coins is arranged in stacks of 10 and 5 are left. If the set of coins is arranged in stacks of 15, 5 are left. Can we always say how many will be left if the coins are arranged in stacks of 20? What about 30 ?

Q5 A man of height H whose eyes are at height $H - e$ stands in front of a mirror of length l which is h meters above the ground. What possible values can l take?

Math Aptitude

Q6 Consider a integer number line $0 \ldots n$. A person is at position i initially. From that position he starts moving either forward or backward. He goes to $i + 1$ or $i - 1$ with equal probability. He stops if he reaches either 0 or n (i.e the either end of the number line). What is the probability that he reaches 0.

Q7 A $2 - 3$ tree is a tree with all internal nodes having either two or three children. If the number of leaves is 100, what is the maximum and minimum number of nodes that the tree can have?

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*Unofficial and Incomplete: Src url: `www.cse.iitb.ac.in/~jagadish/phd_test.pdf`

Q8 How many Hamiltonian cycles are present in a complete bipartite graph of n nodes on either side?

Q9 Let A and B be two subsets of $\{1, 2, \ldots, n\}$. $[\pi_1, \pi_2, \ldots, \pi_n]$ is a random permutation of $1 \ldots n$. What is the probability that $\min_{i \in A} \pi_i = \min_{j \in B} \pi_j$.

Q10 A graph is chordal if each of its cycles of four or more nodes has a chord, which is an edge joining two nodes that are not adjacent in the cycle. Let u and v be two non adjacent nodes. The subgraph formed by the intersection of the common neighbours of u and v is a _____.

Programming

Q11 Write a program to print the largest number of consecutive leaves whose value is 0 in a binary tree, given its node as the argument. (We need to fill in the blanks).

Q12 What values will the program print at the kth iteration of the while loop?

```
ans=0;
a=A;
b=B;
while(a>0){
if(a%2==1) ans +=b;
a=a/2
b=b*2;
cout << a << b << ans;
}
```

Q13 Consider the following function:

```
fun(x,y){
y=y-1
if(x<=3) return x+y;
else
x=x-1;
return fun(x,x)
```

The call `ans=fun(a,b)` is made in the main program. What will be the values of `a,b` and `ans` if `x` and `y` are passed by reference? What will be the values if `x` is passed as reference and `y` as value?