BdIO 2014 Divisional - Short Analysis

(Senior Group)

1. Its a slight modification “Pegionhole Principal”. General formula is K x (N-1) + 1. Why? Because in the worst case when you take K x (N-1) people and there could be N-1 people each from different divisions (if this is not true, then your work is already done) . If you take one more then one of the divisions now have N people.

2. How many binary numbers (bit strings) of length N starts with a 1? 2^(N-1).How many binary numbers (bit strings) of length N ends with two 0s? 2^(N-2). How many binary numbers (bit strings) of length N starts with a 1 and ends with two 0s ? 2^(N-3). So the answer is 2^(N-1) + 2^(N-2) - 2^(N-3) (the last part is subtracted once because its common to first two)

3. As N>=M then we need to hold two circles in the direction of N, so the maximum radius in that direction will be N/4. In the direction of width there is only one circle, so the radius can be M/2. Final answer is minimum between N/4 and M/2.EDIT: There is also a diagonal case to check.

4. Total number of sides are 2 x N. In 1 min you can fry 10 sides. So the ans is ceiling of (2 x N)/10. One special case is that answer can never be less than 2 minutes.

5. Suppose for length N the answer is F(N). If we put the 2 x 1 tile first, then we have N-1 length to cover. That can be done using F(N-1) ways. If we put the 2 x 2 tile first, then we have N-2 length to cover. That can be done using F(N-2) ways. So, F(N) = F(N-1) + F(N-2)

6. Let say, the distance D of a leaf from the root is number of nodes in the path from root to that leaf. The observation is that, each leaf value is multiplied with 2^D when it reaches the root.

7. I am really lazy to write this one. But you can try and solve it in http://www.lightoj.com/volume_showproblem.php?problem=1008

(Junior Group)

1. Its a slight modification “Pegionhole Principal”. General formula is K x (N-1) + 1. Why? Because in the worst case when you take K x (N-1) people and there could be N-1 people each from different divisions (if this is not true, then your work is already done) . If you take one more then one of the divisions now have N people.

2. You need to look at the differences between elements in the series. First one is 5 (6 - 1), second one is 7 (13 - 6), third one is 9 (22 - 13), and so on. So the Nth term of the series is 1 more than the summation of odd numbers starting from 5. Which is (N-1) x (N + 3) + 1. [Try deriving sum of (N-1)th term of the series 5 + 7 + 9 + ...]. N*(N+2) -2 is also correct.

3. Take the fruit from the box labeled "Mixture".

4. Its a greedy problem. Always take the largest coin possible.

5. Here r = b/2 = 1.5. So the answer is pi x (1.5) x (1.5)

6. Its multiplication of number of roads between each city. For example as there are 3 cities from city A to the next city, and 2 road from that city to city C, so in total there are 3 x 2 ways from city A to city C. So from city A to city B its 3 x 2 x 3 x 3.

7. Total number of sides are 2 x N. In 1 min you can fry 10 sides. So the ans is ceiling of (2 x N)/10. One special case is that answer can never be less than 2 minutes.

Analysis Written By: Hasnain Heickel Jami