University of Asia Pacific
Department of Computer Science and Engineering
Class Test - 01

Course Code: CSE 401(B)   **Course Title:** Mathematics for Computer Science
**Total Marks:** 20   **Time:** 45(35+10) mins

1. Suppose, n = (Last 2 digits of your id)%3   **05**
       m =   Last 2 digits of your id
    Note that, **%** refers to the **mod** operation.

    If n=0: find the maximum number of regions created by m lines.
    If n=1: find the maximum number of regions created by m zigs.
    If n=2: find the maximum number of regions created by m zig-zags.

2. Find the position of the last survivor in a Josephus problem, using an algorithm,   **10**
    where there are n people, and every q-th person is eliminated.
    Here, n = (Last 2 digits of your id)%4 + 12
    and, q = (Last 2 digits of your id)%3 + 3
    Note that, **%** refers to the **mod** operation.

    For example, if the last 2 digits of someone's id is 16.
    Then, n = 16%4 + 12
             = 0 + 12
             = 12
    And, q = 16%3 + 3
             = 1 + 3
             = 4
    So, he will find the position of the last survivor in a Josephus problem, using an
    algorithm, where there are **12** people, and every **4**-th person is eliminated.

3. Suppose there are **2n** people in a Josephus problem, where the first **n** people are   **05**
    good, and last **n** people are bad. Show that there is always an integer **q** (depending
    on **n**) such that, if we go around the circle executing every
    q-th person, all the bad guys are first to go.
    For example, if **n** = 3, That means the 1st, 2nd and 3rd person are good people and
    4th, 5th and 6th person are bad people. Now , if we set **q**= 5, meaning we eliminate
    every 5th person, then the following situation will occur:
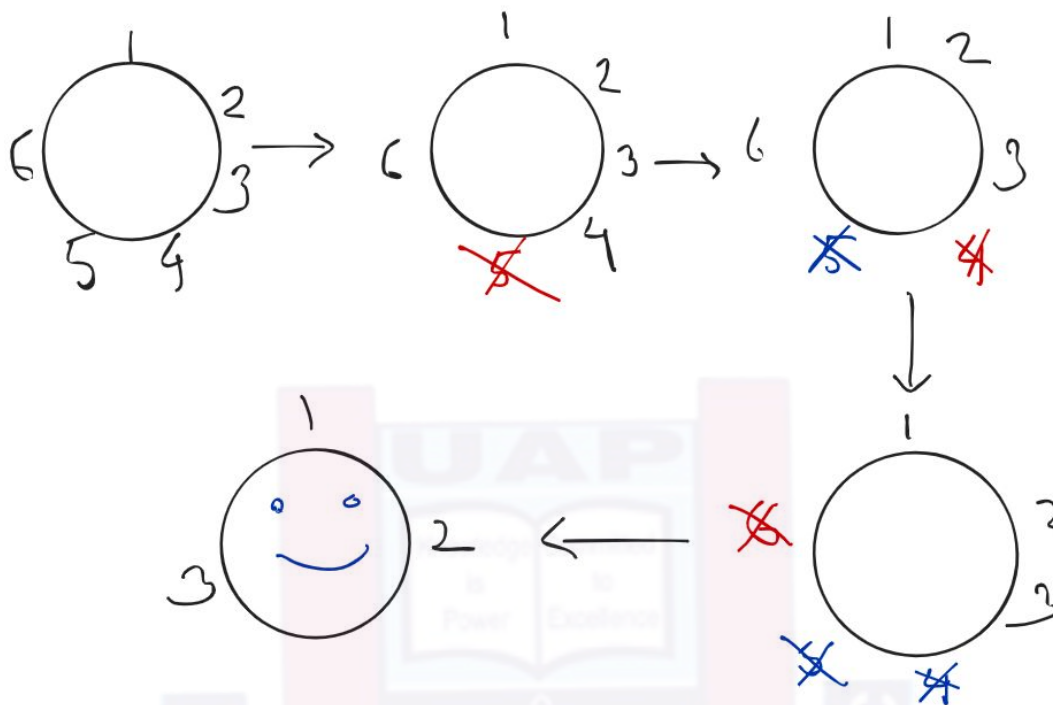
So, after some iteration, we see that all the bad guys are eliminated.
But this is just a simulation. Can you think of a strategy for setting the value of *q,* so that in a Josephus problem with *2n* people, always the people numbered
n+1, *n*+2, ... ,*2n*
will be eliminated first?

[Hint: Some kind of multiples? Also note that for the above simulation, *q*=5 is just one of many possible values and the general strategy for setting the *q* may not give *q*=5. But any value of *q* works, if the 4th,5th and 6th person are eliminated first in the above example.]

[P.S.: A section did not get this type of question in their first CT. Don't worry, in the next CT, they will get one question like this and you won't :v]