

# Takneek 2016

## Nutcracker 2

September 3, 2016

### Rules

- Points for each questions will be awarded only to the complete and clear proof / solution.
- Pools will be ranked according to number of points obtained.
- Ties will be resolved in favour of a pool having an earlier submission.
- No submissions will be considered after the deadline ( 10 am tomorrow).
- Have fun!

### Problems

1. There are charged particles lying on each natural numbered point of the X-axis such that the charge at 2,5,8 ... etc is  $-2q$  whereas the other points  $q$ . Find out the potential at the origin. (5 points)
2. You are a shopkeeper in the city of Istanbul in the 11th century. You have a weighing balance which you use everyday to check the weights of the items which come into your store. You know that the values which you need to check are only natural numbers which lie between 1 & 3,280(both included). You need to find the least number of fixed weight blocks you need to accomplish this task and also give the values of the weights of these blocks. (5 points)

3. The equation

$$(\alpha - 1)(\alpha - 2) \dots (\alpha - 2016) = (\alpha - 1)(\alpha - 2) \dots (\alpha - 2016)$$

is displayed on a computer screen. Clearly, each of the expressions on the left and right sides is a linear factor. As a network administrator, you have been assigned the job to delete a number of linear factors from the equation(any number from either side) such that  $\exists$  at least one factor on each side after the deletion and the resulting equation does not have any real solutions. As you are very lazy, you want to find the minimum possible number of expressions you need to delete to achieve this task. (10 points)