PROBLEM SET 3

Counter Controlled Repetition

1. **For each of the following loops, determine how many times each loop will be repeated, and what the value of the loop index will be when the loop terminates.**

a) `for (x = 2; x < 10; x += 3)`
    `...`
    `...`

d) `for (m = 30; m > 19; m += 2)`
    `...`
    `...`

b) `for (j = 10; j >= 2; j -= 2)`
    `...`
    `...`

e) `for (k = 20; k > 2; k -= 5)`
    `...`
    `...`

c) `for (n = 10; n <= 1; n--)`
    `...`
    `...`
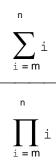
f) `for (y = 0; y >= 2; y--)`
    `...`
    `...`

2. Analyze the following problems and develop a program for each of them.

a) A substance floats in water if its density (mass / volume) is less than 1 gr/cm^3 (1 gram per cubic centimeter) and sinks otherwise. Given the mass in kg. and volume of 10 objects in cm^3, display whether each one will sink or float.

b) Display the odd numbers from 5 to 50 together with their squares.

c) Display the even numbers from 100 down to 50 together with their square roots.

d) Given the value of X, compute the result of the following formula, using the built-in function **pow**.

$$1 + X^2 + X^4 + X^6 + \ldots + X^{100}$$

e) Given the value of X, compute the result of the following formula, <u>without</u> using the built-in function **pow**.

$$1 + X + X^2 + X^3 + \ldots + X^{100}$$

f) Given the values m and n, calculate the result of the following formula (You need to validate that 0 < m < n):

$$\dfrac{\displaystyle\sum_{i=m}^{n} i}{\displaystyle\prod_{i=m}^{n} i}$$

g) Given 10 numbers, display each number together with its square and square root. Display also the sum of the numbers, the sum of their squares and the sum of their square roots.

h) Given 50 numbers, find the minimum and the maximum of those numbers.

i) Given 1000 numbers, find the percentage of positive numbers. The general formula for finding the percentage is:

$$\dfrac{\text{Number of data items fitting the given condition}}{\text{Total number of data items}} \times 100$$

j) Given 50 numbers, output only the numbers which are divisible by 3.

k) Given section number and quiz grades of 100 students, output the number of students in section 1 and the average of students in section 2. (Assume there are three sections)

l) In a company, a worker normally gets 200 YTL per week for upto 40 hours work. For each extra working hour, he gets 7.5 YTL extra pay. Given the number of workers in that company, and each worker's ID number and hours he worked this week, display each worker's ID number and his pay for the week.

m) A company gives 10% salary increase to its workers whose salaries are less than 500 YTL, and 8% salary increase to the other workers. However, 5% of the increase the workers take is cut for a foundation. Given the number of workers in that company, and the amount of the previous salary of each worker, together with his id, calculate the new salary of each worker.

n) A student passes a course if his overall grade is 50 or more. Given the number of students in a class and their overall grades from a course, find how many of them passed, how many of them failed.

o) Given the number of students in a class and the gender (M for male, F for female) of each student, find how many male and how many female students there are in that class. You do not need to check for invalid data.

p) Given the number of students in a class and the letter grade of each student, find how many of each grade (A, B, C, D, F) have been given in that class.

q) Given the number of students in a class and the student ID, midterm1, midterm2 and final exam grades of each student, display the ID of each student together with his/her average grade. Display the message FAIL next to the average grade of a student, if his/her grade is below 50, PASS otherwise.

r) A person invests $1000 in an annual account yielding 5% increase. Assuming that all interest is left in the account, calculate and print the amount of money in the account at the end of each year for 10 years. Use the following formula for determining these amounts:

$$a = p\,(1 + r)^n$$

where

    a: amount in the account at the end of nth year
    p: original amount invested
    r: annual interest rate
    n: number of years

s) In an ice-skating competition, 10 judges give scores to each competitor after his/her performance. The overall score of the competitor is calculated by ignoring the highest and lowest scores and averaging the remaining 8 scores. For example, if the scores are:

    5.5 5.4 5.6 5.7 5.5 5.8 6.0 5.7 5.1 5.6

the scores 6.0 and 5.1 will be ignored and the overall score will be the average of the other scores, thus 5.6.

Given the 10 scores a competitor gets from the judges, output his/her overall score.

t) In Fibonacci's sequence,

    0, 1, 1, 2, 3, 5, 8, 13, …

the first two terms are 0 and 1 and each successive term is found by adding the previous two terms. Given n, output the first n terms of the Fibonacci's sequence.

u) Given an integer n, compute and display the values of y for each x value using the following:

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if  n ≥ 10,        y = x + 5        where  x = 1, 3, 5, ..., n

if  0 < n < 10,    y = −x²          where  x = −n, − (n − 1), ..., 0

if  n < 0,         y = |x + x/3|    where  x = − n, 0, n
```