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Introduction to Computer Science, Winter Semester 2017
Practice Assignment 3

Discussion: 21.10.2017 - 26.10.2017

Exercise 3-1 Discount
To be solved in Lab

A discount is made on a purchase as follows:

- if purchase $\leq$ 1000 L.E., there is no discount
- if purchase $>$ 1000 L.E., the discount is 5%

Given the cost of the purchase, write an algorithm to calculate and print the money paid taking into consideration the 10% sales taxes. The taxes are calculated on the amount after the discount.

Exercise 3-2 Gas Station

National Last Chance gas station sits on Cairo Alexandria route. There is no other gas station for 200 Miles. Write an algorithm to help drivers decide if they need gas or not. The user will enter:

- The capacity of the gas tank, in Gallons.
- The indication of the gas gauge in percent (full=100, three quarters=75 and so on).
- The miles per gallon of the car.

The following is a sample run of the algorithm:

```
Tank Capacity:                 12
Gas Gauge Reading in percent:  50
Miles per Gallon:              30

Get Gas!
```

The algorithm should print out `Get gas` or `Safe to proceed` depending on if the car can cross the 200 miles with the gas remaining in the tank.

Exercise 3-3 BMI
To be discussed in Tutorial

Write an algorithm that determines whether you are underweight, fit, or overweight given your **weight** and **height** based on your BMI calculation.

The BMI is calculated using the weight divided by height squared, where weight is in kg and height is in meters.

- If BMI $\leq$ 18.5, you are underweight
- If BMI $>$ 18.5 and BMI $\leq$ 25, you are fit
- If BMI $>$ 25, you are overweight

Exercise 3-4 Triangle

Write an algorithm that determines whether A, B, and C can form the sides of a triangle. Note A, B and C can form the sides of a triangle if each side is less than the sum of the two other sides, i.e.: $A < B + C, B < A + C$ and $C < A + B$.

If A, B, and C forms a triangle, calculate its area using the formula:

$$Area = \sqrt{S(S-A)(S-B)(S-C)}\ , \quad \text{where } S = (A+B+C)/2$$

Exercise 3-5 Letter Grades
To be discussed in Tutorial

Students marks in a class are graded on the following policy:

- A: 85-100
- B: 74-85
- C: 60-74
- D: 50-60
- F: <50

Keeping in mind that a student cannot score more than 105 marks, nor less than 0 marks.

Write an algorithm that reads each student's marks, print either a grade or an error message.

Exercise 3-6 Student School
To be solved in Lab

The following algorithm prints out whether a current student is in elementary (1st - 5th), middle (6th - 8th), or high school (9th - 12th).

```
grade = eval(input())
if(grade <= 5):
    print("this student is in elementary school")
elif(grade <= 8):
    print("this student is in middle school")
elif(grade <= 12):
    print("this student is in high school")
```

The algorithm above uses nested if-statements.

a) Write an equivalent algorithm that will print the same messages as the algorithm above **without using any nested if-statements**.

b) Discuss the drawback of your algorithm? **Hint:** Compare the efficiency of both algorithms.

Exercise 3-7 Balance
To be discussed in Tutorial

Consider the following algorithm:

```
balance = eval(input())
if((balance >= 2000) or (balance <= 3000)):
    print("Your balance is between 2000$ and 3000$")
    print("Your interest rate will be 3.5%")
else:
    print("Your balance is larger than 3000$")
    print("Your interest rate will be 4.5%")
```

a) Do you think this algorithm does what the programmer intended? Justify your answer.

b) If the algorithm does not do what the programmer intends, improve this algorithm.

Exercise 3-8 Mysterious Task
To be discussed in Tutorial

- What does the following program display for any boolean values x, y and z? Choose one answer from the below choices and Justify.

```
x = eval(input())
y = eval(input())
z = eval(input())
if (x and y):      #if (x == True and y == True)
␣ print((not x) or z)
else:
␣ print((x and y) or z)
```

  a) The value of x
  b) The value of y
  c) The value of z
  d) The value of x and y
  e) Always true
  f) True if either x and y are both True or z is True, and False otherwise.

- Consider a program which changes the value of a boolean variable that tracks whether a light is on or off. Three people, creatively named Sarah, Ali, and Mina, who are claiming to be expert light switchers have written different implementations of this function.

  Sarah's Version:

```
lightOn = eval(input())
if (lightOn):
␣ lightOn = False
else:
␣ lightOn = True
```

  Ali's Version:

```
lightOn = eval(input())
if (lightOn):
␣ lightOn = False
if (not lightOn):
␣ lightOn = True
```

  Minas's Version:

```
lightOn = eval(input())
lightOn = not lightOn
```

  Are these implementations equivalent, i.e. performing the same task? Are all three people expert light switchers? Why? Justify your answer.