# Homework 4 – Conditions and Loops

*Due on Wednesday, October 12, 2016 11:59 AM*

***Instructions:*** Solve problems 1 and 2 on paper or doc file (no separate scripts required). For problems 3-8 write Python scripts (.py files). The code and output screenshot should also be present in the doc file. Use variables where necessary and give meaningful names to variables. All script files should have a comment block at the top, and also provide comments alongside your code. Upload a .pdf/.docx file containing your solutions along with your .py files. If you solve on paper, please upload a good quality scan using CamScanner/Office Lens/iScanner.

**Problem 1.** Analyze the following code. If you (hypothetically) check the condition *count < 100* at the positions in the code designated as *# Point A*, *# Point B*, and *# Point C*, will the condition evaluate to always *True*, always *False*, or sometimes *True* and sometimes *False*? Give your answer for all the three positions. **[10 points]**

```
count = 0
while count < 100:
      # Point A
      print("Programming is fun!")
      count += 1
      # Point B
# Point C
```

**Solution:**

Point A: Always True (we entered the body of the loop)
Point B: Sometimes True and sometimes False (False on the last iteration)
Point C: Always False (we have already exited the loop)

**Problem 2.** How many times does the body of the while loop repeat? What is the output of each loop? **[10 points]**

```
i = 1
while i < 10:
    if i % 2 == 0:
        print(i)
    i += 1
```

**Solution:**

The body of the while loop will repeat 9 times.

| Iteration | Output |
|---|---|
| 1 | *no output* |
| 2 | 2 |
| 3 | *no output* |
| 4 | 4 |
| 5 | *no output* |
| 6 | 6 |
| 7 | *no output* |
| 8 | 8 |
| 9 | *no output* |

**Problem 3.** Write a python script that prompts the user to enter an integer and checks whether the number is divisible by both 5 and 6, divisible by either 5 or 6 (not both), or not divisible by 5 and 6. **[15 points]**

*Sample program output I:*

```
Enter an integer: 10
10 is divisible by either 5 or 6
```

*Sample program output II:*

```
Enter an integer: 30
30 is divisible by both 5 and 6
```

*Sample program output III:*

```
Enter an integer: 14
14 is not divisible by either 5 or 6
```

**Solution:**

```
number = int(input("Enter an integer: "))

if number % 5 == 0 and number % 6 == 0:
    print(number, "is divisible by both 5 and 6")
elif number % 5 == 0 or number % 6 == 0:
    print(number, "is divisible by either 5 or 6")
else:
    print(number, "is not divisible by either 5 or 6")
```

```
 RESTART: C:/Users/aud311/OneDrive/PSU/TA/CMPSC 101 Introduction to Programming/
Homeworks/HW4/problem3.py
Enter an integer: 10
10 is divisible by either 5 or 6
>>>
 RESTART: C:/Users/aud311/OneDrive/PSU/TA/CMPSC 101 Introduction to Programming/
Homeworks/HW4/problem3.py
Enter an integer: 30
30 is divisible by both 5 and 6
>>>
 RESTART: C:/Users/aud311/OneDrive/PSU/TA/CMPSC 101 Introduction to Programming/
Homeworks/HW4/problem3.py
Enter an integer: 14
14 is not divisible by either 5 or 6
>>>
```

**Problem 4.** Write a python script to print the following table to display the sin value and cos value of degrees from 0 to 360 with increments of 10 degrees (the table displayed below has been shortened for space reasons, however your program should generate the complete table). Round the values to four decimal point precision and format the columns so that they are nicely aligned. Do not use any looping structure other than *while*. [Hint: Use the trigonometric functions in the math module to calculate the sin and cos values.] **[25 points]**

```
Deg.  Sin         Cos
0     0.0000      1.0000
10    0.1736      0.9848
…
350   -0.1736     0.9848
360   0.0000      1.0000
```

**Solution:**

```
import math

# Print the table header
print(format('Deg.', '<5s'), format('Sin', '<10.4s'), format('Cos', '<10.4s'))

# Initialize loop counter
deg = 0

while deg <= 360:
    # Convert degree to radians
    rad = math.radians(deg)

    # The round() function is to round of the values to 4 decimal places.
    # + 0 is used to remove the -ve sign for -0.0 values: -0.0 + 0 = 0.0.
    sin = round(math.sin(rad), 4) + 0
    cos = round(math.cos(rad), 4) + 0

    # The values are again formatted with .4f to add trailing 0s to values
    # that had less than 4 precision places.
    print(format(deg, '<5d'), format(sin, '<10.4f'), format(cos, '<10.4f'))

    # Increment loop counter
    deg += 10
```

```
 RESTART: C:\Users\aud311\OneDrive\PSU\TA\CMPSC 101 Introduction to Programming\
Homeworks\HW4\problem4.py
Deg.   Sin        Cos
0      0.0000     1.0000
10     0.1736     0.9848
20     0.3420     0.9397
30     0.5000     0.8660
40     0.6428     0.7660
50     0.7660     0.6428
60     0.8660     0.5000
70     0.9397     0.3420
80     0.9848     0.1736
90     1.0000     0.0000
100    0.9848     -0.1736
110    0.9397     -0.3420
120    0.8660     -0.5000
130    0.7660     -0.6428
140    0.6428     -0.7660
150    0.5000     -0.8660
160    0.3420     -0.9397
170    0.1736     -0.9848
180    0.0000     -1.0000
190    -0.1736    -0.9848
200    -0.3420    -0.9397
210    -0.5000    -0.8660
220    -0.6428    -0.7660
230    -0.7660    -0.6428
240    -0.8660    -0.5000
250    -0.9397    -0.3420
260    -0.9848    -0.1736
270    -1.0000    0.0000
280    -0.9848    0.1736
290    -0.9397    0.3420
300    -0.8660    0.5000
310    -0.7660    0.6428
320    -0.6428    0.7660
330    -0.5000    0.8660
340    -0.3420    0.9397
350    -0.1736    0.9848
360    0.0000     1.0000
>>>
```

**Problem 5.** Write a python script that prompts the user to enter the month number and year and displays the number of days in the month. You need to do the proper leap year calculations based on the year. **[25 points]**

*Sample program output I:*

```
Enter month: 3
Enter year: 2005
March 2005 has 31 days
```

*Sample program output II:*

```
Enter month: 2
Enter year: 2000
February 2000 has 29 days
```

**Solution:**

```
month = int(input("Enter month: "))
year = int(input("Enter year: "))

if month == 1:
    monthName = "January"
    numberOfDaysInMonth = 31
elif month == 2:
    monthName = "February"
    if year % 400 == 0 or (year % 4 == 0 and year % 100 != 0):
        numberOfDaysInMonth = 29
    else:
        numberOfDaysInMonth = 28
elif month == 3:
    monthName = "March"
    numberOfDaysInMonth = 31
elif month == 4:
    monthName = "April"
    numberOfDaysInMonth = 30
elif month == 5:
    monthName = "May"
    numberOfDaysInMonth = 31
elif month == 6:
    monthName = "June"
    numberOfDaysInMonth = 30
elif month == 7:
    monthName = "July"
    numberOfDaysInMonth = 31
elif month == 8:
    monthName = "August"
    numberOfDaysInMonth = 31
elif month == 9:
    monthName = "September"
    numberOfDaysInMonth = 30
```

```
elif month == 10:
    monthName = "October"
    numberOfDaysInMonth = 31
elif month == 11:
    monthName = "November"
    numberOfDaysInMonth = 30
else:
    monthName = "December"
    numberOfDaysInMonth = 31

print(monthName, year, "has", numberOfDaysInMonth, "days")
```

```
 RESTART: C:/Users/aud311/OneDrive/PSU/TA/CMPSC 101 Introduction to Programming/
Homeworks/HW4/problem5.py
Enter month: 3
Enter year: 2005
March 2005 has 31 days
>>>
 RESTART: C:/Users/aud311/OneDrive/PSU/TA/CMPSC 101 Introduction to Programming/
Homeworks/HW4/problem5.py
Enter month: 2
Enter year: 2000
February 2000 has 29 days
>>>
```

**Problem 6.** Write a python script that prompts the user to enter the number of students and each student's score, and displays the highest score along with the student's name. Do not use any looping structure other than *while*. **[25 points]**

*Sample program output:*

```
Enter number of students: 3
Enter student #1 name: Peter
Enter student #1 score: 90
Enter student #2 name: Janet
Enter student #2 score: 98
Enter student #3 name: Jack
Enter student #3 score: 85

Top student: Janet
Score: 98
```

**Solution:**

```
# Initialize variables to keep track of the highest scorer and highest score.
max_score = 0   # This is the lowest score possible
max_scorer = '' # Null, no names are known initially

numOfStudents = int(input("Enter number of students: "))

count = 1
while count <= numOfStudents:
    name = input("Enter student #" + str(count) + " name: ")
    score = int(input("Enter student #" + str(count) + " score: "))
    count = count + 1

    # Equals to check is also needed to update the name
    # if there is only one student and his score is 0.
    if score >= max_score:
        max_score = score
        max_scorer = name

print("\nTop student:", max_scorer, "\nScore:", max_score)
```

```
 RESTART: C:/Users/aud311/OneDrive/PSU/TA/CMPSC 101 Introduction to Programming/
Homeworks/HW4/problem6.py
Enter number of students: 3
Enter student #1 name: Peter
Enter student #1 score: 90
Enter student #2 name: Janet
Enter student #2 score: 98
Enter student #3 name: Jack
Enter student #3 score: 85
Top student: Janet
Score: 98
>>>
```

**Problem 7.** Write a python script that lets the user guess whether a randomly flipped coin displays head or tail. The program randomly generates an integer 0 or 1, which represents head or tail respectively. The program prompts the user to enter a guess value (0 or 1) and reports whether the guess is correct or incorrect. **[25 points]**

*Sample program output I (computer guesses Tail):*

```
Enter 0 for Head and 1 for Tail: 0
Sorry, it is a tail.
```

*Sample program output II (computer guesses Head):*

```
Enter 0 for Head and 1 for Tail: 0
You guessed correctly!
```

*Sample program output III (computer guesses Head):*

```
Enter 0 for Head and 1 for Tail: 1
Sorry, it is a head.
```

**Solution:**

```
import random

# Obtain the random number 0 or 1
number = random.randint(0, 1)

# Prompt the user to enter a guess
guess = int(input("Enter 0 for Head and 1 for Tail: "))

# Check the guess
if guess == number:
    print("You guessed correctly!")
elif number == 0:
    print("Sorry, it is a head.")
else:
    print("Sorry, it is a tail.")
```

```
 RESTART: C:/Users/aud311/OneDrive/PSU/TA/CMPSC 101 Introduction to Programming/
Homeworks/HW4/problem7.py
Enter 0 for Head and 1 for Tail: 1
Sorry, it is a head.
>>>
 RESTART: C:/Users/aud311/OneDrive/PSU/TA/CMPSC 101 Introduction to Programming/
Homeworks/HW4/problem7.py
Enter 0 for Head and 1 for Tail: 1
You guessed correctly!
>>>
 RESTART: C:/Users/aud311/OneDrive/PSU/TA/CMPSC 101 Introduction to Programming/
Homeworks/HW4/problem7.py
Enter 0 for Head and 1 for Tail: 0
Sorry, it is a tail.
>>>
```

**Problem 8.** Write a python script to calculates a person's body mass index (BMI). The BMI is often used to determine whether a person is overweight or underweight for his or her height. BMI is calculated with the following formula:

$$BMI = \frac{weight}{(height)^2} \times 703$$

Weight is measured in pounds (lb) and height is measured in inches (in). The program should ask the user to enter his or her weight and height and then display the user's BMI. The program should also display a message indicating whether the person has optimal weight, is underweight, or is overweight based on the given table. **[15 points]**

| | |
|---|---|
| BMI > 25 | Overweight |
| 18.5 <= BMI <= 25 | Normal |
| BMI < 18.5 | Underweight |

*Sample program output:*

```
Enter weight (lb): 134
Enter height (in): 66
BMI: 21.62
You are normal.
```

**Solution:**

```
# Get the weight and height from the user
weight = float(input('Enter weight (lb): '))
height = float(input('Enter height (in): '))

# Calculate the body mass index
BMI = weight / (height ** 2) * 703

# Display BMI
print('BMI:', format(BMI, '.2f'))

# Determine and display weight category
if BMI > 25:
    print('You are overweight.')
elif BMI >= 18.5:
    print('You are normal.')
else:
    print('You are underweight.')
```

```
 RESTART: C:/Users/aud311/OneDrive/PSU/TA/CMPSC 101 Introduction to Programming/
Homeworks/HW4/problem8.py
Enter weight (lb): 134
Enter height (in): 66
BMI: 21.63
You are normal.
>>>
```