Carnegie Mellon University in Qatar

Principles of Computing

15-110 - Fall 2018

Homework Assignment 2

Out: September 18, 2018

Due: 10:00 AM, September 27, 2018

2pts 1. Which of the following statements is/are not valid in Python, if any?

   (a) `(True or x) == True`
   (b) `(False and x) == False`
   (c) `True or False == False`
   (d) `not (False and True) is not False and True`

5pts 2. Give the truth table that shows the (Boolean) value of each of the following Boolean expressions, for every possible combination of "input" values. (Hint: including columns for intermediate expressions is helpful).

   (a) `not (P and Q)`
   (b) `(not P) and Q`
   (c) `(not P) or (not Q)`
   (d) `(P and Q) or R`
   (e) `(P or R) and (Q or R)`

5pts 3. The following program is supposed to calculate and show the time it takes for light to travel from the sun to the earth. It contains some logical (or semantic) errors. Fix the program so that it will run and show the intended value. You need not explain the errors. Just submit your bug-free program in a Python module (e.g., you can name this module `Light_Travel.py`).

```python
def main():
  #distance from sun (150 million kilometers)
  kmFromSun = 150000000

  lightSpeed = 299792458 #meters per second

  #convert distance to meters
  mFromSun = kmFromSun * 1000

  seconds = mFromSun /lightSpeed
  print("Light will use", end = " ")
  val = seconds
  getInMinutes(val)
  print(val, "minutes")

def getInMinutes(v):
  v = v * 60

main()
```

3pts 4. The following program includes a (silly) decision structure:

```python
a, b, c = eval(input("Enter three numbers: "))

if a > b:
  if b > c:
    print("Spam Please!")
  else:
    print("It is a late parrot!")
elif b > c:
  print("Cheese Shoppe")
  if a >= c:
    print("Cheddar")
  elif a < b:
    print("Gouda")
  elif c == b:
    print("Swiss")
else:
  print("Trees")
  if a == b:
    print("Chestnut")
  else:
    print("Larch")
print("Done")
```

Show the output that would result from each of the following possible inputs:

(a) 3, 4, 5

(b) 3, 3, 3

(c) 5, 4, 3

(d) 3, 5, 2

(e) 5, 4, 7

(f) 3, 3, 2

10pts 5. The body mass index (BMI) is calculated as a person's weight (in pounds) times 720, divided by the square of the person's height (in inches). A BMI in the range 19-25, inclusive, is considered healthy. Write a program that calculates a person's BMI and prints a message telling whether they are above, within, or below the healthy range. Make your program modular and readable via using functions (e.g., create a function that calculates and returns a person's BMI) and comments. Submit your program in a separate Python module (e.g., you can name this module `BMI.py`).

10pts 6. Assume the speeding ticket fine policy in Qatar is 500QAR plus 10QAR for each mile per hour (i.e., mph) over the limit plus a penalty of 2,000QAR for any speed over 90 mph. Write a program that accepts a speed limit, which shall be always less than 90mph, and a clocked speed. Afterwards, your program should either print a message indicating the speed was legal or print the amount of the fine, if the speed is illegal. Make your program modular and readable via using functions and comments. Submit your program in a separate Python module (e.g., you can name this module `Fine_Policy.py`).

7. A formula for computing Easter in the years 1982-2048, inclusive, is as follows:

Let :

$a = year\%19$
$b = year\%4$
$c = year\%7$
$d = (19a + 24)\%30$
$e = (2b + 4c + 6d + 5)\%7$

The date of Easter is `March 22 + d + e` (which could be in April).

9pts   a. Write a program that inputs a year, verifies that it is in the proper range, and then prints out the date of Easter that year. Submit this program in a separate Python module (e.g., you can name this module `Easter1.py`).

6pts   b. The formula for Easter you used in (i) works for every year in the range 1900-2099 except for 1954, 1981, 2049, and 2076. For these 4 years it produces a date that is one week too late. Modify the program you wrote in (i) to work for the entire range 1900-2099. Submit this program in a separate Python module (e.g., you can name this program `Easter2.py`).