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CSCI 121

Handout #22A
September 30, 2018

Solutions to Practice Midterm #1

Problem 1: Simple Python expressions (10 points)

IDLE

```
>>> ALPHABET = "ABCDEFGHIJKLMNOPQRSTUVWXYZ"
>>> 9 * 8 * (7 // 6 + 5) * 4 + 3 - 2 * 1
1729
>>> 7 < 9 - 5 and 3 % 0 == 3
False
>>> ALPHABET[5:15:3]
FILO
>>> ord("F") - ord("A")
5
>>>
```

The number 1729 is the famous (at least among mathematicians) "taxicab number" that I mentioned in class. The brilliant Indian mathematician Ramanujan instantly recognized 1729 as the smallest integer that could be represented as the sum of two cubes in two different ways ($9^3 + 10^3$ and $1^3 + 12^3$).

Problem 2: Program tracing (10 points)

Mystery

```
ad
deaddead
deadhead
```

Problem 3: Simple Python programs (15 points)

```
# File: PythagoreanTriples.py

"""
This program finds all sets of integers a, b, and c so that a < b <= MAX and

        2      2       2
      a   +  b    =  c
"""

import math

# Constants

MAX = 25

def PythagoreanTriples():
    for a in range(1, MAX):
        for b in range(a + 1, MAX + 1):
            csq = a ** 2 + b ** 2
            c = round(math.sqrt(csq))
            if (c ** 2 == csq):
                print(str(a) + ", " + str(b) + ", " + str(c))

# Startup code

if __name__ == "__main__":
    PythagoreanTriples()
```

Problem 4: Using the Portable Graphics Library (20 points)

```
# File: RedCross.js

"""
This program solves the practice midterm problem.
"""

from pgl import GWindow, GCompound, GRect
from gtools import createFilledRect
import random

# Constants

GWINDOW_WIDTH = 800
GWINDOW_HEIGHT = 600
CROSSBAR_LENGTH = 60
CROSSBAR_BREADTH = 20
TIME_STEP = 20
CROSS_SPEED = 2

def RedCross():
    def clickAction(e):
        nonlocal direction
        if gw.getElementAt(e.getX(), e.getY()) == cross:
            direction = random.uniform(0, 360)

    def step():
        cross.movePolar(CROSS_SPEED, direction)

    gw = GWindow(GWINDOW_WIDTH, GWINDOW_HEIGHT)
    cross = createRedCross(CROSSBAR_LENGTH, CROSSBAR_BREADTH)
    direction = random.uniform(0, 360)
    gw.add(cross, gw.getWidth() / 2, gw.getHeight() / 2)
    gw.addEventListener("click", clickAction)
    timer = gw.createTimer(step, TIME_STEP)
    timer.setRepeats(True)
    timer.start()

def createRedCross(length, breadth):
    """
    Creates a GCompound consisting of a red cross centered at the origin.
    The parameters length and breadth specify the larger and smaller
    dimension of the rectangles forming the cross, respectively.
    """
    cross = GCompound()
    horizontalBar = createFilledRect(-length / 2, -breadth / 2,
                                     length, breadth, "Red")
    verticalBar = createFilledRect(-breadth / 2, -length / 2,
                                   breadth, length, "Red")
    cross.add(horizontalBar)
    cross.add(verticalBar)
    return cross

# Startup code

if __name__ == "__main__":
    RedCross()
```

Please remember that the midterm is <u>open-book.</u>
Wednesday, October 3, 3:10–4:30 P.M., PSYCH 105