CSCI-UA.0002-008 – Midterm Exam #1 (v1)

October 13th, 2015

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Ask the person to your left for their first name (leave blank if next to empty seat or wall):

____________________

Ask the person to your right for their first name (leave blank if next to empty seat or wall):

____________________

Keep this test booklet closed until the class is prompted to begin the exam

• Computers, calculators, phones, textbooks or notebooks are not allowed during the exam
• Please turn off your phone to avoid disrupting others during the exam
1. Write the result, True or False (or error if applicable) for the following boolean expressions and statements. (2 points)
   a) 42 == '42'  False
   b) 'bank' > 'bask'  False
   c) 42 < '42'  Error
   d) False and True or Not True  False or error

2. Read the code in the first column. Answer questions about the code in the second and third columns. (6 points total)

<table>
<thead>
<tr>
<th>Code</th>
<th>Question #1</th>
<th>Question #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>result = 0</td>
<td>How many times will this loop run? (1 point)</td>
<td>What is the output of this program? Show your calculations/work. (2 points)</td>
</tr>
<tr>
<td>for num in range(15, 4, -3):</td>
<td>4</td>
<td>26</td>
</tr>
<tr>
<td>if num % 2 == 0:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>result += 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>else:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>result += num</td>
<td></td>
<td></td>
</tr>
<tr>
<td>print(result)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   | count = 1                      | What is the output of the code on the left? (1 point) | Change/fix the program (you can do this directly in the code in left-most column) so that the output is the same as the following (do not use a for loop, and do not use multiple consecutive if statements): (2 points) |
   | while count <= 5:              | 0           | 1           |
   |   if count != 3:               | 1           | 2           |
   |       print(count)             | (then loop forever) |             |
   |   num = random.randint(0, 5)  |             |             |
   |   print(i + num * '!)         |             |             |
   | or only move count to above if|             |             |

3. Your friend is part of an avant-garde acapella group, and they've written a program to write the lyrics to their next song. The song's lyrics consists of numbers, “mmmm” and “bzzzz” (um, what? Art!). Your friend's program is supposed to:
   a) print out numbers from 50 down to (and including) 0, by 5's...
   b) after each number, add a random number (1-5) of exclamation points
   c) if the number is greater than or equal to 40, always print out bzzzz (instead of the number and instead of mmmm)
   d) however, for the remaining numbers, if the number ends in a 0, print out mmmm instead of the number

   Unfortunately, their program (shown below) is full of errors. It does not produce the expected output! Circle 3 errors (there are more than 3), identify if they're a syntax, runtime or logical error... and briefly explain why. Draw arrows or label with numbers to associate error with explanation (6 points)

<table>
<thead>
<tr>
<th>Expected Output</th>
<th>Broken Code (should produce output on left, but does not!)</th>
</tr>
</thead>
<tbody>
<tr>
<td>bzzzz</td>
<td>for i in range(50, 0, -5): 1</td>
</tr>
<tr>
<td>bzzzz</td>
<td>if i % 10 == 0: 2</td>
</tr>
<tr>
<td>bzzzz</td>
<td>print(&quot;mmmm&quot;)</td>
</tr>
<tr>
<td>35!!!!!!</td>
<td>else if i =&gt; 40: 3, 4</td>
</tr>
<tr>
<td>mmmm</td>
<td>print(&quot;bzzzz&quot;)</td>
</tr>
<tr>
<td>25!!!!!!</td>
<td>else:</td>
</tr>
<tr>
<td>mmmm</td>
<td>num = random.randint(0, 5) 5</td>
</tr>
<tr>
<td>15!!!</td>
<td>print(i + num * '!) 6</td>
</tr>
<tr>
<td>mmmm</td>
<td></td>
</tr>
<tr>
<td>5!</td>
<td></td>
</tr>
<tr>
<td>mmmm</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Error #</th>
<th>Type</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Logical</td>
<td>Should be range(50, -1) to include 0</td>
</tr>
<tr>
<td>2</td>
<td>Logical</td>
<td>Switch condition with i &gt;= 40 ( &gt;= 40 takes priority for bzzzz)</td>
</tr>
<tr>
<td>3</td>
<td>Syntax</td>
<td>else if should be elif</td>
</tr>
<tr>
<td>4</td>
<td>Syntax</td>
<td>=&gt; should be &gt;=</td>
</tr>
<tr>
<td>5</td>
<td>Logical</td>
<td>Use randint to generate 1 to 5 (not 0 to 5)</td>
</tr>
<tr>
<td>6</td>
<td>Runtime</td>
<td>TypeError: adding non-string (i) to string</td>
</tr>
</tbody>
</table>

4. Using DeMorgan’s laws followed by equivalent expressions with logical opposites, rewrite the boolean expression below: (1 point)
   not (x > 10 and y > 10)
   (a) Using DeMorgan's Laws: not (x > 10) or not (y > 10)
   (b) Removing not's from (a) using logical opposites: x <= 10 or y <= 10
5. Answer the following questions about loops? (3 points)
   a) In Python, define **count-controlled loop**. What is the construct/control structure (keyword) that represents it?
      
      A loop that repeats a specific number of times... a for loop in Python
   
   b) Define **condition-controlled loop**. What is the construct/control structure (keyword) that represents it?
      
      A loop that repeats as long as a condition is true... a while loop in Python
   
   c) Explain why you would use one kind of loop over the other?
      
      Use a for loop when you know how many iterations you want; use a while loop when the number of iterations is based on a condition (number of iterations is not known beforehand)

6. **Name 4 built-in functions** that are not `int`, `str`, `float`, or `bool`. Give the type of the return value for each function. (3 points)

<table>
<thead>
<tr>
<th>Built-in Function</th>
<th>Type of Return Value (None if no value is returned)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 print, input</td>
<td>None, str</td>
</tr>
<tr>
<td>#2 abs, len</td>
<td>float or int, int</td>
</tr>
<tr>
<td>#3 Type, format</td>
<td>type, str</td>
</tr>
</tbody>
</table>

7. What is the output of the following code (no output and error are possible)? Note the number of spaces if there is left or right padding. (3 points)
   
   a) `print(format('hello', '.2f'))` Error
   
   b) `print(format('hello', '<8s') + format(42, '.1f'))` hello 42.0 3 spaces between
   
   c) `print(format(0.90, '.2%'))` 90.00%

8. In the **truth table** below, fill out all of the possible Boolean values for `p` and `q`, as well as the result of `p or not q`. (2 points)

<table>
<thead>
<tr>
<th>p</th>
<th>q</th>
<th>p or not q</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRUE</td>
<td>TRUE</td>
<td>TRUE</td>
</tr>
<tr>
<td>TRUE</td>
<td>FALSE</td>
<td>TRUE</td>
</tr>
<tr>
<td>FALSE</td>
<td>TRUE</td>
<td>FALSE</td>
</tr>
<tr>
<td>FALSE</td>
<td>FALSE</td>
<td>TRUE</td>
</tr>
</tbody>
</table>

9. Determining what the following program will print out based on the user input specified in the 1st column of the table below. **Show your work for partial credit**. (4 points)

   ```python
   n = int(input('Gimmeh a number!
> '))
if n == 1 or n == 2:
    print(n - 1)
elif n > 0:
    prev = 0
    cur = 1
    for i in range(0, n - 2):
        cur, prev = (prev + cur), cur
    print(cur)
else:
    print('Invalid Input')
```

<table>
<thead>
<tr>
<th>User Input</th>
<th>Resulting Output to Screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>Invalid Input</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>
10. Convert the following numbers. Show work for partial credit. (2 points)
   a) 10000100 is \textbf{132} in decimal.  
   b) 15 is \textbf{00001111} in binary.

11. Circle all of the \textbf{valid variable names} (1 point): $\text{foo}$ \text{foo} $\_\text{foo}$ 2$\_\text{foo}$ \text{foo}2

12. Name two data \textbf{types} in Python that are not \textbf{numeric}, and give a \textbf{syntactically correct} literal example of each. (2 points)
   \begin{itemize}
     \item type: \textbf{str, bool}  \textbf{example: 'hello', True}
     \item type: \textbf{range}  \textbf{example: range(5)}
   \end{itemize}

13. Write a program that computes that \textbf{asks} the user for \textbf{two numbers}. It will \textbf{compute} the \textbf{greatest common factor} that divides evenly into both numbers. (5 points)
   \begin{itemize}
     \item a) Ask for the first number ('Enter num …')
     \item b) No validation is necessary – you can assume that the numbers coming in are whole numbers greater than 0
     \item c) Print out the largest number that divides evenly into both numbers entered ('The gcf that divides both <num 1> and <num 2> is <greatest common factor>')
     \item d) Hint: one strategy might be to try all possible numbers (what are the boundaries... does it matter which factor is smaller?) to see which ones are divisors
     \item e) Hint: what operator would you use to determine if a number is a divisor (divides evenly)?
     \item f) Hint: your algorithm can be entirely inefficient (that is, you can try factors that you know won't work!)
     \item g) Example output below:
   \end{itemize}

   \textbf{Run 1:}
   Enter num 1
   > 17
   Enter num 2
   > 4
   The gcf that divides both 17 and 4 is 1

   \textbf{Run 2:}
   Enter num 1
   > 30
   Enter num 2
   > 36
   The gcf that divides both 30 and 36 is 6

   \begin{verbatim}
x = int(input('Enter num 1\n> '))
y = int(input('Enter num 2\n> '))
gcf = 1
for factor in range(1, x + 1):
    if x % factor == 0 and y % factor == 0:
        gcf = factor
print('The gcf that divides both', x, 'and', y, 'is', gcf)
# or count down and break
# optionally check to see which one is smaller
\end{verbatim}
14. Write a program that continually rolls 2 six-sided dice. Stop rolling dice once at least two “easy fours” (1 and 3) are rolled, and at least one “hard four” (2 and 2) is rolled. (10 points)

a) **Continually** roll two six-sided dice
b) Print out the dice roll: 'rolled <roll1> and <roll2>'
c) If it's an easy four (one die is 1, and the other is 3), print out 'easy four'
d) If it's a hard four (both dice are 2), print out 'hard four'
e) If there are at least 2 "easy fours" and 1 "hard four" rolled, **stop rolling**!
f) Print out the number of "easy fours", "hard fours" and total number of rolls (see output below)
g) Hint: notice that you can go over those limits if the other isn’t reached
h) Hint: pay close attention to the condition that keeps your loop going!
i) Hint: an “easy four” can be 3, 1 … or 1, 3, while a “hard four” is always just 2, 2
j) Example output below (extraneous output omitted, expanded to two columns to save space – output should be single column)

```
import random
easy_min, hard_min = 2, 1
easy_fours, hard_fours = 0, 0
total = 0
while easy_fours < easy_min or hard_fours < hard_min:
    d1, d2 = random.randint(1, 6), random.randint(1, 6)
    print('rolled ' + str(d1) + ' and ' + str(d2))
    if d1 == 1 and d2 == 3 or d1 == 3 and d2 == 1:
        easy_fours += 1
        print('easy four')
    elif d1 == 2 and d2 == 2:
        hard_fours += 1
        print('hard four')
total += 1
print('=====')
print('easy fours: ' + str(easy_fours))
print('hard fours: ' + str(hard_fours))
print('total rolls: ' + str(total))
```

```
rolled 5 and 4
rolled 5 and 6
rolled 3 and 1
easy four
rolled 5 and 6
rolled 1 and 4
<more dice rolls, output omitted>
rolled 3 and 1
rolled 1 and 3
easy four
<more dice rolls, output omitted>
rolled 3 and 4
rolled 2 and 2
hard four
rolled 3 and 4
easy fours: 3
rolled 3 and 5
hard fours: 1
rolled 4 and 6
total rolls: 44
```

```
import random
easy_min, hard_min = 2, 1
easy_fours, hard_fours = 0, 0
total = 0
while easy_fours < easy_min or hard_fours < hard_min:
    d1, d2 = random.randint(1, 6), random.randint(1, 6)
    print('rolled ' + str(d1) + ' and ' + str(d2))
    if d1 == 1 and d2 == 3 or d1 == 3 and d2 == 1:
        easy_fours += 1
        print('easy four')
    elif d1 == 2 and d2 == 2:
        hard_fours += 1
        print('hard four')
total += 1
print('=====')
print('easy fours: ' + str(easy_fours))
print('hard fours: ' + str(hard_fours))
print('total rolls: ' + str(total))
```
You’re writing an essay, and you’d like to avoid using short words (so you can sound super smart!). You decide to write a program to help you out. The program will ask you for words, one-at-a-time, to create an essay until the total number of characters (including spaces) of all words entered reach a specified threshold (that is, the length of your essay is greater than the threshold). However, your program will reject words that are 3 letters or less. (5 points)

a) Ask the user how many characters they want the essay to be...
b) Continually ask the user for a word until that number of characters is equalled or exceeded: 'Give me word <word #>'
c) When a user enters a word, only add it to the essay if it’s more than 3 characters

d) If it’s not more than 3 characters, say ‘Oops, that word isn’t long enough!’, don’t add the word to the essay, and keep going (the word number should not have increased)
e) Add a space after every word (the spaces are included in the calculations for the total number of characters in the essay); it’s ok if there’s a space at the end of the essay

f) Print out the essay once the number of characters is equalled or exceeded

g) Example output below:

```
How many characters do you want?
>10
Give me word 1
>Hey
Oops, that word isn't long enough!
Give me word 1
>Hello
Give me word 2
>There
Hello There
```

```python
max_chars = int(input('How many characters do you want?\n>'))
sentence = ''
count = 1
while len(sentence) <= max_chars:
    word = input('Give me word ' + str(count) + '\n>')
    if len(word) >= 4:
        sentence += word + ' '  
count += 1
else:
    print('Oops, that word isn\'t long enough!')
print(sentence)
```