CPSC 217 Final Examination

Duration: 120 minutes

20 April 2010

- This exam has 70 questions and 16 pages.
- This exam is closed book. No notes, books, calculators or electronic devices, or other assistance may be used.
- Mark your answers on the supplied answer sheet.
- Assume numbers are base ten unless stated otherwise.
- Assume questions refer to Python unless stated otherwise.
- If you think multiple answers may be correct, choose the best answer.

Answer at least 60 of the following 70 questions. You may answer more to get a bonus, but you will not be given a score higher than 65.

Part 1

1. TRUE/FALSE: $17 \% 3 == 2$
2. TRUE/FALSE: $3 * "5" + "2" == "17"
3. TRUE/FALSE: len([]) == len('')
4. TRUE/FALSE: [ [1, 2], [3, 4] ][1][0] results in a list.
5. TRUE/FALSE: p and not p
6. TRUE/FALSE: p and not q is equal to not (p or q) for all possible values of p and q.
7. TRUE/FALSE: Lists and dictionaries are immutable data types.
8. TRUE/FALSE: Using both black- and white-box tests can always prove that a program is bug-free.
9. TRUE/FALSE: The maximum value that a 16-bit unsigned integer holds is 65535.
10. TRUE/FALSE: Both for loops and while loops cause the loop body to be executed at least once.

11. 156 is a base ten number. What is it in hexadecimal?
   (A) C9
   (B) 234
   (C) 8B
   (D) 9C
12. What is the minimum number of bits required to represent any one of 13 different things?
   (A) 14  
   (B) 13  
   (C) 12  
   (D) 5   
   (E) 4

13. 156 is a base ten number. What is it in binary?
   (A) 1001100  
   (B) 00111001  
   (C) 1101110  
   (D) 10001011

14. What is the result in octal of adding 26_7 and 110011_2?
   (A) 71_8  
   (B) 87_6  
   (C) 87_8  
   (D) 107_8

15. Consider the following code segment:

   ```python
   s = AAA
   ```

   If this code is supposed to output
   Feb. 29, 2012

   what should the string `s` be assigned (i.e., what should go in the spot labelled `AAA`)?
   (A) "29-February-2012"  
   (B) "29-Feb-12"  
   (C) "February 29, 2012"  
   (D) Either (A) or (B) above.  
   (E) None of the above.

16. What is the output when this code is run?

   ```python
   def A(x):
       x = x + 2
       print x,
       x = 3
   A(x)
   print x
   ```

   (A) 5 5  
   (B) 2 3  
   (C) 5 3  
   (D) 2 2  
   (E) An error occurs when it is run.
17. What is the output when this code is run?

```python
def A(L,i):
    L[i] = i**2
L = [1,2,3]
A(L,2)
print L
```

(A) [1,2,3]
(B) [1,4,3]
(C) [1,2,4]
(D) An error occurs when it is run.

18. What is the output when the same code as in the previous question is run, but with the function call replaced by `A(L,3)`?

(A) [1,2,3,9]
(B) [1,2,9]
(C) [1,2,3]
(D) An error occurs when it is run.

19. An algorithm is:

(A) The result of computer programming.
(B) A finite sequence of effective steps to solve a problem.
(C) Expressed in a specific programming language.
(D) Something that can only be created by following the top-down design methodology.
(E) A mathematical function found in Python’s `math` module.

20. A raster image:

(A) Represents an image by specifying a color for each pixel in it.
(B) Consists of a collection of lines and other geometric primitives.
(C) Can conveniently be represented in Python using a multidimensional list.
(D) Two of the above.
(E) None of the above.

21. Given integer variables `x = 22` and `y = 7`, which statement will output 22 / 7 is approximately 3.14 exactly?

(A) `print '%d / %d is approximately %.f' % (x,y,float(x)/float(y))`
(B) `print '%d / %d is approximately %.2f' % (x,y,x/y)`
(C) `print '%d / %d is approximately %.2f' % (x,y,float(x)/float(y))`
(D) `print '%d / %d is approximately %.2f' % (x,y,x/y)`

22. Databases are better suited than sequential text files for representing large collections of data because:

(A) A well-designed schema can minimize the amount of repeated data.
(B) Access to the data is more efficient
(C) Updating multiple entries that share the same data is more efficient.
(D) All of the above.
(E) None of the above.
23. What does the following code do when run? (Recall that \n is the newline character.)

```python
f = open('foo.py', 'w')
f.write('if __name__ == "__main__":
')
f.write('print "foo"
')
f.close()
import foo
```

(A) Prints foo  
(B) Prints nothing  
(C) An error occurs when it is run.

24. What does this code print when run?

```python
def bla():
    print 'Before: x in bla() is', x,
    x = "Cat"
    print 'After: x in bla() is', x,
bla()
x = "Hello"
print 'x in main is', x
```

(A) Before: x in bla() is Hello, After: x in bla() is Cat, x in main is Hello  
(B) Before: x in bla() is Hello, After: x in bla() is Cat, x in main is Cat  
(C) The statement x = "Cat" will cause an error because x is immutable  
(D) The statement print 'Before: x in bla() is', x, will cause an error because x is undefined

25. Consider a function with the following header: `def drawSomething (x, y, r):`

We make the following calls to the function, one at a time:

- `drawSomething (300, r=200, y = 400)` #Call 1  
- `drawSomething (300, 200, y = 400)` #Call 2  
- `drawSomething (x=300, y=400, 200)` #Call 3  
- `drawSomething (x=300, 400, r = 200)` #Call 4

Which of the calls above will execute without causing an error?

(A) Only 1  
(B) Only 1 and 2  
(C) They all will execute without any errors except 3  
(D) They all will execute without any errors except 4  
(E) They all will execute without any errors

26. When using the PPM module, a 400x300 colored image is represented using a 3D matrix \( M \). What do the indices in the statement \( M[i][j][k] \) represent?

(A) \( i, j \) and \( k \) respectively represent the x, y and z coordinates of a pixel.  
(B) \( i \) and \( j \) respectively represent the x and y coordinates of a pixel, while \( k \) represents a specific color component in that pixel.  
(C) \( i, j \) and \( k \) respectively represent the red, green and blue color components in a pixel.  
(D) None of the above.
27. What is the output of this piece of code?

L = [1, 2, 4, 8]
K = L
K.append(16)
print L, K

(A) [1, 2, 4, 8] [1, 2, 4, 8, 16]
(B) [1, 2, 4, 8, 16] [1, 2, 4, 8]
(C) [1, 2, 4, 8, 16] [1, 2, 4, 8, 16]
(D) [1, 2, 4, 8] [1, 2, 4, 8]

28. The file mystery.py contains the following Python program:

```python
import sys
def multiply(x):
    return x*(x-1)
try:
    x = int(sys.argv[1])
except:
    # note this is the same as x = int(raw_input())
    x = input()
print multiply(x),
```

What is the output when we execute this command?

```bash
python mystery.py 3 | python mystery.py
```

(A) 6
(B) 6 6
(C) 30
(D) 6 30
(E) This will cause an error, because a Python program cannot be piped into itself.

29. The following function is supposed to return the average of a given list. When we pass \(N=[0, 1, 2, 3]\) to the function, the function returns 1 as opposed to the expected outcome of 1.5. What do we call this kind of error?

```python
def getAverage(N):
    total = 0
    for num in N:
        total = total + num
    return total/len(N)
```

(A) Syntax error
(B) Logic error
(C) Run-time error
(D) Execution error
30. Syntax errors:

(A) Are usually caught during a program’s execution using try and except.
(B) Are identified before the program runs.
(C) Are the most difficult type of errors to find.
(D) Arise from incorrectly formatted input.

31. What is the output when the code below is run?

```python
def foo(x,n):
    if n == 1:
        return x
    if n % 2 == 1:
        return x*foo(x,(n-1)/2)**2
    else:
        return foo(x,n/2)**2

print foo(2,5)
```

(A) 1
(B) 2
(C) 8
(D) 16
(E) 32

32. At the Unix prompt, to list only the files with filenames containing either of the letters p or y, you would type

(A) ls *py*
(B) ls *p*y*
(C) ls *p* *y*
(D) ls *[yp]*
(E) Either (C) or (D).

33. You have a file called data.txt containing tab-separated data from a physics experiment, and you have the following Python program called minmax.py:

```python
import sys
L = []
for line in sys.stdin:
    L.append(float(line))
print min(L)
print max(L)
```

You want to find the minimum and maximum values of the first column of data, so you would run

(A) cut -c0 data.txt | python minmax.py
(B) cut -c1 data.txt | python minmax.py
(C) cut -f0 data.txt | python minmax.py
(D) cut -f1 data.txt | python minmax.py
(E) cut -f1 | python minmax.py data.txt
34. Given a solvable Sudoku puzzle, generate all possible combinations of the missing numbers, and check which combination offers the right solution. This technique can be categorized under which type of algorithms?

(A) Greedy algorithms  
(B) Divide-and-conquer algorithms  
(C) Brute-force algorithms  
(D) Sorting algorithms  
(E) None of the above

35. Which sorting algorithm does this program perform?

```python
#Given a list of integers A  
A = [4,1,0,-9,3,0,-10,5,23,98]  

#assume the first element is sorted  
for i in range (1,len(A)):  
    #then take the next element to be placed in order  
    j = i  

    #keep swapping the current element with the one before it  
    #until you reach a smaller element or you hit the beginning of the list  
    while j>0 and A[j]<A[j-1]:  
        temp = A[j]  
        A[j-1] = temp  
        j = j - 1
```

(A) Insertion sort  
(B) Bubble sort  
(C) Shell sort  
(D) Quick sort

36. Consider the following program:

```python
def hypotenuse(a,b):
    """    >>> hypotenuse (8,6)
    10
    >>> hypotenuse (3,4)
    5.0
    """
    return (a*a + b*b)**0.5

if __name__ == "__main__":
    import AAA
    AAA.testmod()
```

In order to run the test cases in the function hypotenuse, what should AAA be replaced with?

(A) hypotenuse  
(B) testing  
(C) testmodule  
(D) doctest
Part 2

Consider the following code segment for the next two questions. Note that `math.sqrt` always returns a floating-point number.

```python
import math
if x > 0:
    y = math.sqrt(x)
else:
    if x == 0:
        y = 0
    else:
        y = math.sqrt(-x)
if y*y == x:
    print x, 'is a perfect square!'```

37. What is the minimal number of test cases required to achieve statement coverage?
   (A) 2
   (B) 3
   (C) 4
   (D) 5

38. Which of the following values for x causes the “perfect square” message to be printed?
   (A) 0
   (B) 2
   (C) 4
   (D) Two of the above
   (E) All of (A), (B), and (C)

Part 3

The following code is supposed to read in the lines of an input file called `sales.txt` and store the contents in a dictionary. Each line is assumed to be of the form

```
name s1 s2 s3 ... sn
```

where `name` denotes a character string representing an employee’s last name and is followed by 0 or more integers (separated by spaces or tabs) representing sales totals. The dictionary should use the names as keys and store the sales figures (as strings) corresponding to each name in a list.

```python
inf = open(AAA)
D = {}

while line != "":
    L = CCC
    DDD
    BBB
    EEE
```
39. What should go in the spot labeled AAA?
   (A) "sales.txt", "r"
   (B) "sales.txt", "w"
   (C) "r", "sales.txt"
   (D) "w", "sales.txt"

40. What should go in the two spots labeled BBB?
   (A) line = inf.read()
   (B) inf.readline(line)
   (C) line = inf.readline()
   (D) line = inf.nextline()

41. What should go in the spot labeled CCC?
   (A) line.split()
   (B) line.words()
   (C) list(line)
   (D) line.split("\t")

42. What should go in the spot labeled DDD?
   (A) D.append(L[0], L[1:len(L)])
   (B) D[L[0]] = L[1:len(L)]
   (C) D[L[0]] = L[1:]
   (D) Both (B) and (C) would work.
   (E) More than one line of code is required.

43. What should go in the spot labeled EEE?
   (A) close(inf)
   (B) inf.close()
   (C) inf.close("sales.txt")
   (D) Nothing

The following code is supposed to determine the name of the employee with the highest amount of sales, given the dictionary created in the previous sequence of questions.

```python
def mostSales(D):
    name = ""
    max = 0
    for employee AAA:
        total = 0
        for i BBB:
            total = CCC
        if total > max:
            max = total
            name = employee
    return name
```
44. What should go in the spot labeled AAA?
   (A) in D.keys()  (note this is the same as in D)
   (B) in range(len(D.keys()))
   (C) in D.values()
   (D) in range(0, len(D))

45. What should go in the spot labeled BBB?
   (A) in D
   (B) in range(0, len(D[employee]))
   (C) in range(0, len(D))
   (D) in D[employee]

46. What should go in the spot labeled CCC?
   (A) total + i
   (B) total = i
   (C) total = int(i)
   (D) total + int(i)

**Part 4**

Study the following Python program and answer the questions that follow:

```python
#poetReader.py
filename = raw_input("Enter the file name: ")
x = raw_input("How many lines to read? ")

try:
    lines = int(x)
    f = open(filename, 'r')
    f.read(4)

    for i in range(1, lines+1):
        line = f.readline()
        print "Line", i,".:" , line,

    f.close()
    print "DONE"

except IOError:
    print "IO Error"
except EOFError:
    print "EOF Error"
```

47. When we opened the file, we passed 'r' as the opening mode. What does this mean?
   (A) This is called the “read-only” mode. Only read operations are permitted.
   (B) This is called the “rewrite” mode. We can read from the file and rewrite its content.
   (C) This is called the “read-plus-append” mode. We can read from the file and append to it, but we cannot rewrite its content.
   (D) This is called the “read-plus-write” mode. All read and write operations are permitted.

```
#data.txt
One fine day in the middle of the night
Two dead boys got up to fight..
Back to back they faced each other,
And drew their swords and shot each other,
A deaf policemen heard the noise
And got up to arrest the two boys
If you think this story isn't true
Ask the blind man..
He saw it too.
```
48. If we run the program above and provide the following input, which lines of the file data.txt will be printed?

Enter the file name: data.txt
How many lines to read? 2

(A) Line 1: A deaf policemen heard the noise
   Line 2: And got up to arrest the two boys
(B) Line 5: A deaf policemen heard the noise
   Line 6: And got up to arrest the two boys
(C) Line 1: fine day in the middle of the night
   Line 2: Two dead boys got up to fight..
(D) Line 1: One fine day in the middle of the night
   Line 2: Two dead boys got up to fight..

49. If we run the program above and provide the following input, what will be printed on the screen given that the file someOtherPoem.txt does not exist?

Enter the file name: someOtherPoem.txt
How many lines to read? 4

(A) The word DONE will be printed.
(B) The statement IO Error will be printed.
(C) The statement EOF Error will be printed.
(D) Both (A) and (B) are correct.
(E) Both (A) and (C) are correct.

50. We would like to catch a third type of exception when the user provides a non-integer value for the number of lines (variable x). That is, at the end of the program we would like to add:

```python
except ZZZ:
    print "The number of lines should be an integer"
```

What should we replace ZZZ with?

(A) TypeError
(B) NameError
(C) ArithmeticError
(D) ValueError

51. Suppose we successfully added the third exception as described in the previous question. What error message(s) will appear when we run the program with the following input? (As before, someOtherPoem.txt does not exist.)

Enter the file name: someOtherPoem.txt
How many lines to read? x

(A) IO Error
(B) EOF Error
(C) The number of lines should be an integer
(D) Both (A) and (C)
(E) Both (B) and (C)
Part 5

The stock market data for Google, Inc. is stored in a file called goog.csv. The first few lines of the file are shown below:

Date, Open, High, Low, Close, Volume, Adj Close
2010-04-13, 572.53, 588.88, 571.13, 586.77, 3845200, 586.77
2010-04-12, 567.35, 574.00, 566.22, 572.73, 2352400, 572.73
2010-04-09, 567.49, 568.77, 564.00, 566.22, 2056600, 566.22
2010-04-08, 563.32, 569.85, 560.05, 567.49, 1947500, 567.49
2010-04-07, 567.30, 568.75, 561.86, 563.54, 2581000, 563.54

Each line (except the first one) contains data for a different date, and the fields in each line are separated by commas. The 5th field is the closing price, e.g., on 2010-04-13, the closing price was $586.77.

The program below should print the average (i.e., the mean) closing price for this stock using all the data in the data file.

AAA

```python
file = open('goog.csv', 'r')
header = True
n = 0
sum = 0.0
for line in file:
    if header:
        header = False
    else:
        fields = line.strip().split(',
        sum = sum + float(Close)
        n = n + 1
print sum / n
```

52. What should go in the spot labeled AAA?

(A) import file
(B) import filio
(C) import fileio
(D) import system
(E) Nothing

53. What should go in the spot labeled BBB?

(A) 'a'
(B) 'r'
(C) 'r+'
(D) 'w'
(E) 'x'
54. What should go in the spot labeled CCC?
   (A) each line
   (B) file.read()
   (C) file.line()
   (D) line in file
   (E) line in file.readline()

55. What should go in the spot labeled DDD?
   (A) n == 0
   (B) header = True
   (C) header == True
   (D) header = False
   (E) header == False

56. What should go in the spot labeled EEE?
   (A) break
   (B) header = True
   (C) header == True
   (D) header = False
   (E) header == False

57. What should go in the spot labeled FFF?
   (A) line.split()
   (B) line.split(,)
   (C) line.split(,,)
   (D) line.split( ')'
   (E) line.split(\t')

58. What should go in the spot labeled GGG?
   (A) line[4]
   (B) line[5]
   (C) fields[4]
   (D) fields[5]
   (E) fields[]

**Part 6**

Use the following program to answer the questions in this section.

```python
import turtle

s = raw_input()
for cmd in s:
    if cmd == 'f':
        turtle.fd(50)
    elif cmd == 'l':
        turtle.lt(90)
    elif cmd == 'h':
        turtle.home()
```
59. To draw a square, you would give the input
   (A) 1f1f1f1f
   (B) f1f1f1f1f
   (C) ff1f1f1f1f
   (D) Either (A) or (B)
   (E) Any of (A), (B), or (C)

60. The input ff1fh draws a
   (A) Square
   (B) Rectangle
   (C) Pentagon
   (D) Triangle
   (E) Rhombus

Part 7

A black and white image is represented by $M$. $M$ is a list of rows, and each row is a list of Boolean values that represent
the individual bits in a row of the image. (In other words, $M$ is a list of lists, as you have seen used for 2-D data.)

The following code inverts the image, flipping each bit from True to False or False to True.

```python
for i in AAA:
    for j in BBB:
        CCC
```

61. What should AAA be replaced with?
   (A) $M$
   (B) len($M$)
   (C) range($M$)
   (D) range(len($M$))

62. What should BBB be replaced with?
   (A) $M$
   (B) $M[i]$
   (C) len($M$)
   (D) range($M$)
   (E) range(len($M[i]$))

63. What should CCC be replaced with?
   (A) $M[i][j] = \text{not } M[i][j]$
   (B) $M[i][j] = \text{not } M[j][i]$
   (C) $M[j][i] = \text{not } M[i][j]$
   (D) $M[j][i] = \text{not } M[j][i]$
The following program is supposed to read lines of text until the sentinel EOF, and count the frequency of each lowercase letter in the input. For example, the input

```
baby
EOF
```
gives the output `{'a': 1, 'y': 1, 'b': 2}`.

```python
D = AAA
while BBB:
    s = raw_input()
    if CCC:
        break
    for DDD:
        if EEE:
            if FFF:
                D[ch] = GGG
            else:
                D[ch] = 1
print D
```

64. What should AAA be replaced with?

(A) 0
(B) ()
(C) []
(D) {}

65. What should BBB be replaced with?

(A) 0
(B) True
(C) False
(D) s != 'EOF'
(E) s != EOF

66. What should CCC be replaced with?

(A) s = EOF
(B) s = 'EOF'
(C) s == EOF
(D) s == 'EOF'
(E) s is not EOF

67. What should DDD be replaced with?

(A) ch in s
(B) ch in 'abcdefghijklmnopqrstuvwxyz'

68. What should EEE be replaced with?

(A) ch in s
(B) ch in 'abcdefghijklmnopqrstuvwxyz'
69. What should FFF be replaced with?

(A) D[ch]
(B) D{ch}
(C) ch in D
(D) ch not in D

70. What should GGG be replaced with?

(A) D[ch]
(B) D[ch+1]
(C) D[ch]+1
(D) D[+1]
(E) +1