CPSC 231 Final Exam

Duration: 120 minutes

23 April 2016

• This exam has 65 questions and 17 pages.
• You may use one single-sided 8.5x11” piece of paper with whatever you want written on it. Apart from that, 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.
• If you think there are multiple correct answers to a question, select the best answer.
Part 1

1. What does this code print when it is run?

```python
class C1:
    def m1(self):
        print('A')
    def m2(self):
        self.m1()

class C2(C1):
    def m1(self):
        print('B')
x = C1()
y = C2()
x.m2()
y.m2()
```

(A) B, then A, in that order
(B) B, then B again
(C) A, then A again
(D) There is an error when this code is run
(E) A, then B, in that order

2. What does this code print when it is run?

```python
class C:
    def __init__(self, x):
        self.x = x
    def m1(self):
        print(self.x)
    def m2(self):
        print(x)
x = 123
y = C(x)
x = 42
y.m1()
y.m2()
```

(A) There is an error when this code is run
(B) 42, then 123, in that order
(C) 123, then 42, in that order
(D) 42, then 42 again
(E) 123, then 123 again

3. -9 is a base ten number. What is it represented as a 6-bit binary number using sign/magnitude representation?

(A) 100101
(B) It cannot be represented
(C) 101001
(D) 100100
(E) 001001
4. -12 is a base ten number. What is it represented as a 5-bit binary two’s complement number?

(A) 11001
(B) 10100
(C) It cannot be represented
(D) 11100
(E) 01100

5. 79 is a base 10 number. What is it in base 8?

(A) 019
(B) 65
(C) 910
(D) 117
(E) 711

6. 1110010110 is a binary number. What is it in base 16?

(A) 918
(B) 196
(C) 396
(D) 1cb

7. 1110010110 is a binary number. What is it in octal?

(A) 626
(B) 713
(C) 918
(D) 1626

8. 762 is a base 8 number. What is it in hexadecimal?

(A) 2731
(B) 27310
(C) 498
(D) 1f2
(E) 1372

9. Below are two programs, a.py and b.py.

```python
# a.py
for i in range(1,4):
    print(i)

# b.py
n = int(input())
input()
n = n * int(input())
print(n)
```

What is the result of running

```sh
grep -A 1 
```

(A) 1 is printed
(B) 2 is printed
(C) 6 is printed
(D) 3 is printed
(E) 0 is printed
Part 2

A truth table for Boolean variables is a table that shows all possible combinations of some Boolean variables (here, x and y), and the result of computing a Boolean function for each set of values. Starting with the following:

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
<th>x and (not y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>False</td>
<td>False</td>
<td>AAA</td>
</tr>
<tr>
<td>False</td>
<td>True</td>
<td>BBB</td>
</tr>
<tr>
<td>True</td>
<td>False</td>
<td>CCC</td>
</tr>
<tr>
<td>True</td>
<td>True</td>
<td>DDD</td>
</tr>
</tbody>
</table>

10. What should AAA be replaced with?
   (A) True
   (B) False

11. What should BBB be replaced with?
   (A) True
   (B) False

12. What should CCC be replaced with?
   (A) True
   (B) False

13. What should DDD be replaced with?
   (A) True
   (B) False

Part 3

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

class C1:
    def __init__(self):
        print('A')
    def m1(self):
        print('B')
    def m2(self):
        print('C')
class C2(C1):
    def __init__(self):
        print('D')
        super().__init__()
    def m1(self):
        super().m1()
        print('E')
    def m2(self):
        print('F')
class C3(C2):
    def __init__(self):
        super().__init__()
        print('G')
    def m1(self):
        super().m1()
        print('H')

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14. What is printed when the following code is run?

```python
x = C1()
y = C1()
x.m1()
y.m1()
```

(A) A, B, and B, in that order
(B) There is an error when this code is run
(C) A, A, B, and B, in that order
(D) B, then B again
(E) A, then B, in that order

15. What is printed when the following code is run?

```python
x = C2()
x.m1()
```

(A) D, then E, in that order
(B) A, D, E, and B, in that order
(C) A, then B, in that order
(D) D, A, B, and E, in that order
(E) A, D, B, and E, in that order

16. What is printed when the following code is run?

```python
x = C2()
y = C1()
x = y
x.m2()
```

(A) There is an error when this code is run
(B) A, D, A, and F, in that order
(C) D, A, A, and F, in that order
(D) D, A, A, and C, in that order
(E) A, D, A, and C, in that order

17. What is printed when the following code is run?

```python
x = C3()
```

(A) G only
(B) A, then G, in that order
(C) D, A, and G, in that order
(D) A, D, and G, in that order
(E) G, D, and A, in that order

18. Assuming x is an instance of class C3, what is printed when the following code is run?

```python
x.m1()
```

(A) F, then H, in that order
(B) H, then F, in that order
(C) H, F, and C, in that order
(D) C, F, and H, in that order
(E) H only
Part 4

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

```python
def f(n):
    if n < 5:
        return n - 2
    return n - f(n - 1)
```

19. What is $f(-3)$?
   (A) 1  
   (B) -1  
   (C) -5  
   (D) $f$ will recurse infinitely

20. What is $f(12)$?
   (A) $f$ will recurse infinitely  
   (B) 2  
   (C) 6  
   (D) 10

Part 5

In this section, you are writing a function that has one argument: a list of coordinates, expressed as (x, y) coordinate pairs. The function should compute the cumulative Euclidean distance that would be traveled by moving from one coordinate to the next in order. For example, `cumdist([(1,1)])` returns 0.0; `cumdist([(1,1),(3,1)])` returns 2.0; `cumdist([(1,1),(3,1),(3,5)])` returns 6.0. Starting with the following:

```python
def cumdist(L):
    AAA
    for i in BBB:
        CCC
        d = DDD
        tot = EEE
    return tot
```

21. What should AAA be replaced with?
   (A) `tot = 0.0`
   (B) `tot = L`
   (C) `tot = 1.0`
   (D) `tot = None`
   (E) Nothing
22. What should BBB be replaced with?
   (A) range(len(L)) - 1
   (B) range(len(L) - 1)
   (C) len(L) - 1
   (D) len(L)
   (E) range(len(L))

23. What should CCC be replaced with?
   (A) x1 = L[i][0]
y1 = L[i+1][0]
x2 = L[i][1]
y2 = L[i+1][1]
   (B) x1 = L[0][i]
y1 = L[1][i]
x2 = L[0][i+1]
y2 = L[1][i+1]
   (C) x1 = L[0][i]
y1 = L[0][i+1]
x2 = L[1][i]
y2 = L[1][i+1]
   (D) x1 = L[i][0]
y1 = L[i][1]
x2 = L[i+1][0]
y2 = L[i+1][1]

24. What should DDD be replaced with?
   (A) ((x2 - x1)**2 + (y2 - y1)**2) * 0.5
   (B) ((x2 - x1)**2 + (y2 - y1)**2) * 1/2
   (C) ((x2 - y2)**2 + (x1 - y1)**2) ** 0.5
   (D) ((x2 - x1)**2 + (y2 - y1)**2) * 1//2
   (E) ((x2 - x1)**2 + (y2 - y1)**2) ** 0.5

25. What should EEE be replaced with?
   (A) L
   (B) tot + d
   (C) d
   (D) tot * d
   (E) 0.0
Part 6

In this section, you are writing a function that returns True if a tic-tac-toe board has three Xs or three Os in a row, or False if the board does not have three Xs or three Os in a row. For example, given the following board definition:

board = [['X', 'O', None],
          [None, 'X', 'O'],
          [None, 'O', 'X']]

then won(board) would return True. Starting with the following:

def checkrow(B, r, c, dr, dc):
    AAA
    for i in range(BBB):
        xo = B[r][c]
    CCC
    DDD
    if EEE:
        return True
    return False

def won(B):
    if (checkrow(B, 0, 0, 0, 1) or
        checkrow(B, 1, 0, 0, 1) or
        checkrow(B, 2, 0, 0, 1) or
        checkrow(B, 0, 0, 1, 0) or
        checkrow(B, 0, 1, 1, 0) or
        checkrow(B, 0, 2, 1, 0) or
        checkrow(B, 0, 2, 1, 0) or FFF):
        return True
    return False

26. What should AAA be replaced with?

(A) tot = 3  
(B) tot = -1  
(C) tot = 1  
(D) tot = 0  
(E) tot = -3

27. What should BBB be replaced with?

(A) 2  
(B) 3  
(C) len(r)  
(D) 1, 3  
(E) 4
28. What should CCC be replaced with?

(A) if xo == 'X':
    tot = tot + 1
    elif xo == 'O':
        tot = tot + 1
(B) if xo == 'X':
    tot = 1
    elif xo == 'O':
        tot = -1
(C) if xo == 'X':
    tot = 1
    elif xo == 'O':
        tot = 1
(D) if xo == 'X':
    tot = tot + 1
    elif xo == 'O':
        tot = tot - 1
(E) if xo == 'X':
    tot = tot - 1
    elif xo == 'O':
        tot = tot - 1

29. What should DDD be replaced with?

(A) r = r + dr
(B) r = dr
    c = dc
(C) Nothing
(D) c = c + dc
(E) r = r + dr
    c = c + dc

30. What should EEE be replaced with?

(A) tot != -3
(B) abs(tot) != 3
(C) abs(tot) == 3
(D) tot == -3
(E) tot == 3

31. What should FFFF be replaced with?

(A) checkrow(B, 0, 0, 1, 1) or checkrow(B, 2, 2, -1, -1)
(B) checkrow(B, 0, 0, -1, 1) or checkrow(B, 2, 0, 1, -1)
(C) checkrow(B, 0, 0, 1, 1) or checkrow(B, 2, 0, -1, 1)
(D) checkrow(B, 0, 2, 1, -1) or checkrow(B, 2, 0, -1, 1)
**Part 7**

In this section, you are writing a program that takes zero or more filenames on the command line. Each file contains a series of lines of the form

```
42:10
21:16
3735928559:16
0:2
2169:13
```

The number before the colon is a base 10 number; the number after the colon is the base to convert the base 10 number to. For example, the output from the above file is

```
42 in base 10 is 42
21 in base 16 is 15
3735928559 in base 16 is deadbeef
0 in base 2 is 0
2169 in base 13 is cab
```

Starting with the following:

AAA

```python
def ten2n(BBB):
    digits = '0123456789abcdef'
    rv = ''
    while True:
        CCC
digit = digits[r]
    DDD
    EEE
def error(s):
    print(FFF)
    exit()

def str2int(GGG):
    try:
        n = int(s)
    except:
        error('bad number')
    if n < 0:
        error('number must be positive')
    HHH

def process(filename):
    try:
        f = open(filename, III)
    except JJJ:
        print(KKK)
        exit()
    LLL:
        fields = line.split(MMM)
    if len(fields) != 2:
        error(NNN)
    OOO
        if base < 2 or base > 16:
            error('base must be between 2 and 16')
            print(number, 'in base', base, 'is', ten2n(number, base))
    PPP
    if QQQ:
        for filename in RRR:
            process(filename)
```
32. What should AAA be replaced with?
   (A) from sys import *
   (B) import sys
       import math
   (C) import sys
       import math
       import turtle
   (D) import sys
   (E) Nothing

33. What should BBB be replaced with?
   (A) Nothing
   (B) number, base
   (C) number
   (D) base, number
   (E) base

34. What should CCC be replaced with?
   (A) r = number % base
       number = number // base
   (B) r = number % base
       number = number / base
   (C) number = number % base
       r = number // base
   (D) number = number // base
       r = number % base

35. What should DDD be replaced with?
   (A) rv.append(digit)
   (B) rv = rv + digit
   (C) rv = digit
   (D) rv = digit + rv

36. What should EEE be replaced with?
   (A) if digit == 0:
       return rv
   (B) if number != 0:
       return rv
   (C) if number == 0:
       return rv
   (D) if r == 0:
       return rv
   (E) if number == 0:
       break

37. What should FFF be replaced with?
   (A) 'error:', s, sys.stdout
   (B) 'error:', s
   (C) 'error:', s, file=sys.stderr
   (D) 'error:', s, sys.stderr
   (E) 'error:', s, file=sys.stdout
38. What should GGG be replaced with?
   (A) int
   (B) s
   (C) str
   (D) Nothing
   (E) n

39. What should HHH be replaced with?
   (A) return
   (B) return n
   (C) return s
   (D) Nothing
   (E) return None

40. What should III be replaced with?
   (A) 'w'
   (B) 'w+'
   (C) 'a'
   (D) 'r+'
   (E) 'r'

41. What should JJJ be replaced with?
   (A) IOError as e
   (B) IOError as e
   (C) IOError
   (D) IOError
   (E) Nothing

42. What should KKK be replaced with?
   (A) filename, ':', e.strerror, file=sys.stderr
   (B) filename, ':', e.strerror, file=sys.stdout
   (C) filename, ':', e.strerror
   (D) filename, ':', e.strerror, sys.stdout
   (E) filename, ':', e.strerror, sys.stderr

43. What should LLL be replaced with?
   (A) for line in f.readlines()
   (B) while f.readline()
   (C) while f.readlines()
   (D) for line in f
   (E) while True

44. What should MMM be replaced with?
   (A) '\t'
   (B) Nothing
   (C) ''
   (D) '/t'
   (E) ':.'
45. What should NNN be replaced with?
   (A) 'too many fields'
   (B) 'wrong number of fields'
   (C) 'not enough fields'

46. What should OOO be replaced with?
   (A) `number = int(fields[0])
b   base = int(fields[1])`
   (B) `number = str2int(fields[0])
b   base = str2int(fields[1])`
   (C) `number = fields[0]
b   base = fields[1]`
   (D) `number = fields[1]
b   base = fields[2]`
   (E) `number = str2int(fields[1])
b   base = str2int(fields[2])`

47. What should PPP be replaced with?
   (A) `f.close()`
   (B) `close()`
   (C) Nothing
   (D) `f.close`
   (E) `close(f)`

48. What should QQQ be replaced with?
   (A) `__name__ == '__main__'`
   (B) `__main__ == '__name__'`
   (C) `__name__ != '__main__'`
   (D) `__main__ != '__name__'`

49. What should RRR be replaced with?
   (A) `sys.argv[1:]`
   (B) `sys.argv[2:]`
   (C) `sys.argv`
   (D) `sys.argv[1]`
   (E) `sys.argv[2]`

50. What would happen if `ten2n` was called with the arguments 5 and 1, in that order?
   (A) Something else not listed here
   (B) `'00000'` would be returned
   (C) An exception would be raised
   (D) An infinite loop
   (E) `'11111'` would be returned

51. What would happen if `ten2n` was called with the arguments 5 and 0, in that order?
   (A) `'00000'` would be returned
   (B) Something else not listed here
   (C) `'11111'` would be returned
   (D) An exception would be raised
   (E) An infinite loop
52. Just as base 16 uses letters a...f, it is possible to use the other letters of the alphabet similarly to represent numbers up to base 36. For example, 'yyc' is a valid base 36 number. What is the minimum number of lines of code that require changing for this program to work with numbers up to base 36?

(A) 1
(B) 4
(C) 5
(D) More than 5
(E) 3

53. yyc is a base 36 number. What is it in base 10?

(A) 45300
(B) 46632
(C) 43968
(D) 45288
(E) 46633

Part 8

In this section, you are writing a program that takes an iTunes playlist on the standard input and prints all artists' names who have more than one track in the playlist, along with the number of tracks they have in the playlist. No artist is printed more than once. As a reminder of the playlist format, the result of the Unix command `cat -tv playlist` shows (in part):

Enough Is EnoughˆIApril WineˆI`IBest of April WineˆI`IRockˆI842...
Turn Up the RadioˆIAutographˆI`ITurn Up the RadioˆI`IRockˆI9866...
Locked Out of HeavenˆIBruno MarsˆI`IUnorthodox JukeboxˆI`IPopˆI...
TreasureˆIBruno MarsˆI`IUnorthodox JukeboxˆI`IPopˆI662300`I178...
Call Me MaybeˆICarly Rae JepsenˆI`ICuriosity - EPˆI`IPopˆI73347...
Get Lucky (feat. Pharrell Williams)ˆIDaft PunkˆI`IRandom Access...

The program is run as

`python3 program.py < playlist`

Starting with the following:

```
AAA
while True:
try:
    BBB
except EOFError:
    CCC
fields = DDD
artist = EEE
if FFF:
    GGG
else:
    HHH
for III:
    if D[artist] > 1:
        print(artist, D[artist])
```

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54. What should AAA be replaced with?
   (A) D = {}
   (B) D = ()
   (C) Nothing
   (D) D = []

55. What should BBB be replaced with?
   (A) line = input()
   (B) input()
   (C) line = f.readline()
   (D) input(line)

56. What should CCC be replaced with?
   (A) pass
   (B) return
   (C) exit()
   (D) break
   (E) continue

57. What should DDD be replaced with?
   (A) split('t')
   (B) split()
   (C) line.split('\t')
   (D) line.split('t')
   (E) line.split()

58. What should EEE be replaced with?
   (A) fields[2]
   (B) fields[0]
   (C) fields[1]
   (D) fields

59. What should FFF be replaced with?
   (A) artist in D
   (B) D[artist]
   (C) artist != D
   (D) artist == D
   (E) artist not in D

60. What should GGG be replaced with?
   (A) D[artist] = 0
   (B) D[artist] = 1
   (C) artist = 1
   (D) D[artist] = D[artist] + 1
   (E) artist = artist + 1
61. What should \( \text{HHH} \) be replaced with?
   (A) \( D = 0 \)
   (B) \( \text{artist} = 1 \)
   (C) \( D[\text{artist}] = 0 \)
   (D) \( D[\text{artist}] = 1 \)
   (E) \( D = 1 \)

62. What should \( III \) be replaced with?
   (A) \( \text{artist} \)
   (B) \( \text{artist in range}(\text{len}(D)) \)
   (C) \( D[\text{artist}] \)
   (D) \( \text{artist in } D \)
   (E) \( D \)

**Part 9**

Use the following two programs, \texttt{a.py} and \texttt{b.py}, to answer the questions in this section.

\begin{verbatim}
# a.py
n = input()
print(n + n)
# b.py
n = input()
print(n * 2)
\end{verbatim}

63. The programs are run using
   \texttt{python3 b.py | python3 a.py}

   and the user enters 3 as input. What is the output?
   (A) Nothing – an error occurs when this is run
   (B) 3333
   (C) 66
   (D) 12
   (E) 6666

64. The programs are run using
   \texttt{python3 a.py | python3 b.py}

   and the user enters 3 as input. What is the output?
   (A) 6666
   (B) 12
   (C) 3333
   (D) Nothing – an error occurs when this is run
   (E) 66

65. The programs are run using
   \texttt{python3 b.py | python3 b.py | python3 a.py}
and the user enters 4 as input. What is the output?

(A) 32
(B) 444444
(C) 1616
(D) Nothing – an error occurs when this is run
(E) 44444444

Answer Key

Q1: E; Q2: C; Q3: C; Q4: B; Q5: D; Q6: C; Q7: D; Q8: D; Q9: D; Q10: B; Q11: B; Q12: A; Q13: B; Q14: C; Q15: D; Q16: D; Q17: C; Q18: A; Q19: C; Q20: C; Q21: A; Q22: B; Q23: D; Q24: E; Q25: B; Q26: D; Q27: B; Q28: D; Q29: E; Q30: C; Q31: C; Q32: D; Q33: B; Q34: A; Q35: D; Q36: C; Q37: C; Q38: B; Q39: B; Q40: E; Q41: B; Q42: A; Q43: D; Q44: E; Q45: B; Q46: B; Q47: A; Q48: A; Q49: A; Q50: D; Q51: D; Q52: E; Q53: A; Q54: A; Q55: A; Q56: D; Q57: D; Q58: C; Q59: A; Q60: D; Q61: D; Q62: D; Q63: B; Q64: C; Q65: E.

End of questions.