This exam has 80 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.
Part 1

1. 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.

2. This code is supposed to print out the string s backwards.

```python
s = 'abcde'
t = ''
for ch in s:
    t = XXX
print(t)
```

What goes in the spot marked XXX?

(A) ch + t
(B) t + ch
(C) ch
(D) s

3. What does the following code print when run?

```python
try:
    print('A')
    int('xxx')
    print('B')
except:
    print('C')
```

(A) A
(B) A B
(C) A C
(D) A B C
(E) Nothing – there is an error in the code

4. Modules should exhibit

(A) low cohesion and high coupling
(B) high cohesion and high coupling
(C) high cohesion and low coupling
(D) low cohesion and low coupling
5. Module foo contains

```python
print('X')
```

How many Xs are printed by

```python
import foo
import foo
import foo
```

(A) 0  
(B) 1  
(C) 2  
(D) 3

6. Consider the following code.

```python
NTRIES = 3
MAX = 10
MIN = 1
try = 0
while try < NTRIES:
    try = try + 1
    s = input()
    n = int(s)
    if MIN <= n and n <= MAX:
        break
```

When run, this code

(A) gives the user two tries to enter a number between 1 and 10  
(B) gives the user three tries to enter a number between 1 and 10  
(C) gives the user four tries to enter a number between 1 and 10  
(D) gives the user multiple tries to enter a number between 0 and 9  
(E) does nothing – there is an error

7. It is usually hard to see the distinction between compilation and interpretation in Python because

(A) Python doesn’t compile code  
(B) Python doesn’t interpret code  
(C) Python doesn’t compile or interpret code  
(D) Compilation happens very fast, immediately before interpretation  
(E) Interpretation happens very fast, immediately before compilation
8. The while statement in Python has an optional else part – this is code which is run if the while loop is not exited with break. Consider the following code.

```python
L = (1, 3, 5, 7)
i = 0
key = 4
while i < len(L):
    if key == L[i]:
        print('key found')
        break
    i = i + 1
else:
    print('key not found')
```

What does this code print when run?

(A) key found
(B) key not found
(C) key found, followed by key not found
(D) Nothing – there is an error

9. What is the minimum number of bits required to represent any key on a 101-key keyboard?

(A) 7
(B) 8
(C) 101
(D) 102
(E) 128

10. How many things can you represent with 5 bytes?

(A) 5
(B) $2^5$
(C) $2^{5-1}$
(D) $2^{40}$
(E) $2^{40-1}$

11. How many nybbles are in 2KiB?

(A) 512
(B) 1024
(C) 2048
(D) 4096
(E) 8192

12. TRUE/FALSE: Software is classed as a literary work under Canadian copyright law.

13. TRUE/FALSE: Canadian copyright law allows fair use.

14. TRUE/FALSE: Copyright protects ideas.

15. TRUE/FALSE: Using other people’s code in your program may affect how you distribute your program.
16. Consider the following code segment:

```python
s1 = 'world hello'
s2 = AAA
print(s2)
```

If the code is supposed to print `hello world`, what should `AAA` be replaced with?

(A) `s1[6:] + s1[5] + s1[:4]`
(B) `s1[6:] + s1[5] + s1[:5]`
(C) `s1[6:len(s1)-1] + s1[5] + s1[:5]`
(D) `s1[7:] + s1[6] + s1[:5]`
(E) `s1[7:] + s1[6] + s1[:6]`

17. Consider the following code segment:

```python
import turtle
# turtle window width
width = turtle.window_width()
# maximum data value
max_x = 42.0
AAA
```

If the code is supposed to compute the value of `x`, scaled to the turtle window’s width, what should `AAA` be replaced with? Assume `x` is already defined.

(A) `scaled_x = x / max_x`
(B) `scaled_x = x / width`
(C) `scaled_x = max_x * x / width`
(D) `scaled_x = width * x / max_x`
(E) `scaled_x = width - x / max_x`

18. 37 is a base ten number. What is it equal to?

(A) `25_{16}`
(B) `45_{8}`
(C) `52_{16}`
(D) `54_{8}`
(E) Both (A) and (B)

19. 61 is a base ten number. What is it in base 16?

(A) `3C`
(B) `3D`
(C) `3E`
(D) `C3`
(E) `D3`
20. 146 is a base eight number. What is it in base 10?
   (A) 92
   (B) 102
   (C) 222
   (D) 816

21. How many Unicode characters can be represented in eight bytes?
   (A) Exactly two
   (B) At most eight
   (C) At least two
   (D) Only one
   (E) (B) or (C)

22. –11 is a base ten number. What is it represented as an 8-bit sign/magnitude number?
   (A) 0000 1011
   (B) 1000 1011
   (C) 1011 0000
   (D) 1011 0001

23. BAD is a hexadecimal number. What is it in binary?
   (A) 1100 1010 1101
   (B) 1011 1011 1101
   (C) 1011 1010 0101
   (D) 1011 1010 1101
   (E) 1011 1110 0101

24. TRUE/FALSE: Good error messages should be printed to the standard output.

25. TRUE/FALSE: When opening a binary file for reading, the second argument to `open` should be `'rb'`.

26. TRUE/FALSE: Typos in a program always result in syntax errors.

27. TRUE/FALSE: Logic errors are the easiest to debug.

28. TRUE/FALSE: Making sure each line of code is executed would be a type of white-box testing.

29. TRUE/FALSE: Pseudocode is one way to express an algorithm.

30. An algorithm that chooses the lowest-cost option at each step would be an example of a
   (A) brute-force algorithm
   (B) divide-and-conquer algorithm
   (C) greedy algorithm
   (D) least-cost algorithm
   (E) randomized algorithm
31. In the code below, the changes to \( L \) and \( n \) should be visible outside the function \( f \).

```python
def f(L):
    AAA
    n = 42
    L.append(1234)

    n = 'abc'
    L = ['a', 'b', 'c']

f(L)
```

What should `AAA` be replaced with?

(A) Nothing  
(B) `global n`  
(C) `global L`  
(D) `global n
global L`  
(E) None of these will work

32. TRUE/FALSE: `False and True`

33. TRUE/FALSE: `type(range(5)) == type([])` *This would have had the opposite answer for Python 2.*

34. TRUE/FALSE: `'a' == 'b' or -5 < 7`

35. TRUE/FALSE: `'3' in str(21 + 13 % 3)`

36. TRUE/FALSE: `(not False) and (not True) == (not (False or True))`

37. TRUE/FALSE: Running a Python program like this

```
python program.py < out.txt
```

sends the program’s standard output to the file `out.txt`.

**Part 2**

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

```python
P = XXX
for i in P:
    if i == '0':
        x = 5
    elif i == 'p':
        x = x + x
    elif i == 't':
        x = x * x
    elif i == 's':
        x = str(x)
    else:
        print(x)
```
38. What will the code above print, if XXX is changed to

'0!'

(A) 0
(B) 5
(C) Nothing
(D) Nothing – there is an error

39. What will the code above print, if XXX is changed to

'0tsp$'

(A) 25
(B) 50
(C) 55
(D) 2525
(E) Nothing

40. What will the code above print, if XXX is changed to

'0pst'

(A) 100
(B) 1010
(C) 10101010101010101010
(D) Nothing
(E) Nothing – there is an error

41. What will the code above print, if XXX is changed to

'0ttt0x'

(A) 5
(B) 125
(C) 1255
(D) Nothing
(E) Nothing – there is an error

Part 3

The urllib module changed between Python 2 and 3.

The following code is supposed to read and print the Nth line number from a file at a particular URL; the variables N and url are set to these values, respectively.

```
N = 4
url = 'http://example.com/file.txt'

f = BBB CCC
for i in DDD:
    line = EEE
FFF
print(line)
```
42. What should go in the spot labeled AAA?
   (A) import http
   (B) import url
   (C) import urllib.request
   (D) import urlopen
   (E) Nothing

43. What should go in the spot labeled BBB?
   (A) http.
   (B) url.
   (C) urllib.request.
   (D) urlopen.
   (E) Nothing

44. What should go in the spot labeled CCC?
   (A) httpopen(url)
   (B) open()
   (C) open(url)
   (D) urlopen()
   (E) urlopen(url)

45. What should go in the spot labeled DDD?
   (A) 4
   (B) N
   (C) range(4)
   (D) range(N)
   (E) range(len(N))

46. What should go in the spot labeled EEE?
   (A) read()
   (B) read(f)
   (C) f.read()
   (D) readline(f)
   (E) f.readline()

47. What should go in the spot labeled FFF?
   (A) close()
   (B) close(f)
   (C) f.close()
   (D) urlclose(f)
   (E) f.urliclose()
Part 4

The following code is supposed to read data from a CSV file whose filename is given as a command-line argument, and print the arithmetic mean of the data in the second field on each line. If no command-line argument is given then the CSV file should be read from the standard input.

AAA

```python
if BBB:
    f = CCC
else:
    f = open(DDD, EEE)

n = 0
sum = 0.0
for FFF:
    fields = GGG
    sum = HHH
    III
print(JJJ)
```

48. What should go in the spot labeled AAA?
   (A) import sys
   (B) import math
   (C) import turtle
   (D) (A) and (B)
   (E) (A), (B), and (C)

49. What should go in the spot labeled BBB?
   (A) sys.argv == 1
   (B) sys.argv[1] == 1
   (C) len(sys.argv) = 1
   (D) len(sys.argv) == 1
   (E) len(sys.argv[1]) == 1

50. What should go in the spot labeled CCC?
   (A) stdin
   (B) stdout
   (C) sys.stdin
   (D) sys.stdout

51. What should go in the spot labeled DDD?
   (A) sys.argv
   (B) sys.argv[]
   (C) sys.argv[0]
   (D) sys.argv[1]
   (E) sys.argv[2]
52. What should go in the spot labeled EEE?
   (A) 'a'
   (B) 'r'
   (C) 'w'
   (D) 'r+
   (E) 'w+'

53. What should go in the spot labeled FFF?
   (A) line in f
   (B) f.readline()
   (C) line in sys.stdin
   (D) fields in line
   (E) fields in f

54. What should go in the spot labeled GGG?
   (A) line.split()
   (B) line.split(' ')
   (C) line.split('	')
   (D) line.split('/t')
   (E) line.split(',')

55. What should go in the spot labeled HHH?
   (A) float(fields[1])
   (B) float(fields[2])
   (C) sum + float(fields[0])
   (D) sum + float(fields[1])
   (E) sum + float(fields[2])

56. What should go in the spot labeled III?
   (A) n + 1
   (B) n = n + 1
   (C) break
   (D) continue
   (E) Nothing

57. What should go in the spot labeled JJJ?
   (A) n
   (B) sum
   (C) fields
   (D) sum / n
   (E) n / sum
Part 5

Assume that a directory contains the following files:

- README
- foo.py
- bar.py
- python
- 1.gif
- 2.gif
- 11.gif

58. Which filenames would the wildcard \[^a-z]* select?
   (A) 1.gif 2.gif 11.gif
   (B) foo.py bar.py python
   (C) README 1.gif 2.gif 11.gif
   (D) README foo.py bar.py python
   (E) None of them

59. Which filenames would the wildcard *py select?
   (A) foo.py bar.py
   (B) foo.py bar.py python
   (C) None of them
   (D) All of them

60. Which filenames would the wildcard *py* select?
   (A) foo.py bar.py
   (B) foo.py bar.py python
   (C) None of them
   (D) All of them

61. Which filenames would the wildcard *.??? select?
   (A) 1.gif 2.gif
   (B) foo.py bar.py
   (C) 1.gif 2.gif 11.gif
   (D) foo.py bar.py 1.gif 2.gif 11.gif
   (E) None of them

62. Which filenames would the wildcard [12]* select?
   (A) 1.gif 2.gif
   (B) 1.gif 2.gif 11.gif
   (C) None of them
   (D) All of them
Part 6

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

\[D = \{(2, 3): 2, 3: 5, 2: 3\}\]
\[L = [1, 2, 3]\]
\[T = (2, 3)\]

63. TRUE/FALSE: \(L\) is immutable.

64. TRUE/FALSE: \(\text{list(range(1, 4))} == L\)

65. TRUE/FALSE: \(\text{len(T[1:2])} == 2\)

66. \(\text{len(D)}\) is
   (A) 3
   (B) 6
   (C) 7

67. \(D[L[3]]\) is
   (A) 2
   (B) 3
   (C) 5
   (D) An error

68. \(D[L[2]]\) is
   (A) 2
   (B) 3
   (C) 5
   (D) An error

69. What would the code below print?

   ```python
   for k in D:
       if k == (2, 3):
           continue
       print(D[k])
   ```
   (A) 5 3
   (B) 3 5
   (C) 2 5 3
   (D) 5 3 2
   (E) (A) or (B)
Part 7

Use the following two programs to answer the questions in this part.

```python
# a.py
s = input()
n = int(s)
print(n + 5)
```

```python
# b.py
s = input()
n = int(s)
print(n * 2)
```

70. The programs are run using

```bash
python b.py | python a.py
```

and the user enters 3 on the keyboard. What is the output?

- (A) 11
- (B) 16
- (C) 65
- (D) 82
- (E) Nothing – there is an error

71. The programs are run using

```bash
python a.py | python b.py
```

and the user enters 3 on the keyboard. What is the output?

- (A) 11
- (B) 16
- (C) 65
- (D) 82
- (E) Nothing – there is an error

72. The programs are run using

```bash
python b.py | python b.py | python a.py
```

and the user enters 4 on the keyboard. What is the output?

- (A) 21
- (B) 28
- (C) 165
- (D) 4225
- (E) Nothing – there is an error

Part 8

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

```python
def f(n):
    if n <= 2:
        return 12
    elif n % 2 == 1:
        return f(n - 1) + 2
    else:
        return f(n - 2) + 3
```
73. The base case is
   (A) n <= 2
   (B) n % 2 == 1
   (C) Neither (A) or (B)

74. f(2) is
   (A) 2
   (B) 12
   (C) An error

75. f(3) is
   (A) 3
   (B) 12
   (C) 14
   (D) 15
   (E) An error

76. f(5) is
   (A) 5
   (B) 12
   (C) 15
   (D) 17
   (E) An error

**Part 9**

The following code is supposed to read a value for n from the standard input, and compute and print

\[
\frac{e^{2\pi} - n}{12n}
\]

AAA
BBB
CCC
DDD
print(num / denom)

77. What should go in the spot labeled AAA?
   (A) import math
   (B) from math import *
   (C) from math import e, pi
   (D) Nothing
78. What should go in the spot labeled BBB?

(A) n = input()
(B) n = raw_input()
(C) n = int(input())
(D) input(n)
(E) int(input(n))

79. What should go in the spot labeled CCC?

(A) num = math.e ** (2 * math.pi) - n
(B) num = math.e ** 2 * math.pi - n
(C) num = math.e ** (2 * math.pi) - n
(D) num = math.e ** 2 * math.pi - n

80. What should go in the spot labeled DDD?

(A) denom = 12n
(B) denom = 12 * n
(C) denom = 12 ** n

**Answer Key**

Q1: B; Q2: A; Q3: C; Q4: C; Q5: B; Q6: E; Q7: D; Q8: B; Q9: A; Q10: D; Q11: D; Q12: true; Q13: false; Q14: false; Q15: true; Q16: B; Q17: D; Q18: E; Q19: B; Q20: B; Q21: E; Q22: B; Q23: D; Q24: false; Q25: true; Q26: false; Q27: false; Q28: true; Q29: true; Q30: C; Q31: B; Q32: false; Q33: false; Q34: true; Q35: false; Q36: true; Q37: false; Q38: B; Q39: D; Q40: E; Q41: A; Q42: C; Q43: C; Q44: E; Q45: D; Q46: E; Q47: C; Q48: A; Q49: D; Q50: C; Q51: D; Q52: B; Q53: A; Q54: E; Q55: D; Q56: B; Q57: D; Q58: C; Q59: A; Q60: B; Q61: C; Q62: B; Q63: false; Q64: true; Q65: false; Q66: A; Q67: D; Q68: C; Q69: E; Q70: A; Q71: B; Q72: A; Q73: A; Q74: B; Q75: C; Q76: D; Q77: A; Q78: C; Q79: C; Q80: B.