

NAME: *ANSWERS*

Closed book. No calculators, no computer.
Write all answers on these sheets. Do not ask questions!

question	1	2	3	4	5	6	7	total
points								
maximum	10	15	15	15	20	15	10	100

1. What is garbage collection?

Garbage collection is the mechanism to deallocate memory for objects no longer being used.

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2. View B3 as a number in the hexadecimal system. What is B3 in the decimal system?

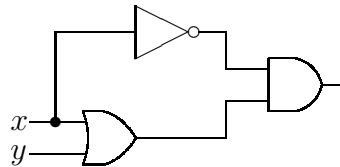
$$B_{16} = 11_{10}$$

B evaluates to 11 in the decimal system.

$$B3 = 11 \times 16 + 3 = 179.$$

/15

3. Consider the circuit drawn below:



- (a) For $x = 1$ and $y = 1$, what is the outcome of this circuit? *ANSWER: 0*
Mark the results on the circuit drawing above.
- (b) What is the logical expression that represents this circuit?

(x OR y) AND NOT x

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4. Let A be a given float representing an annual salary.

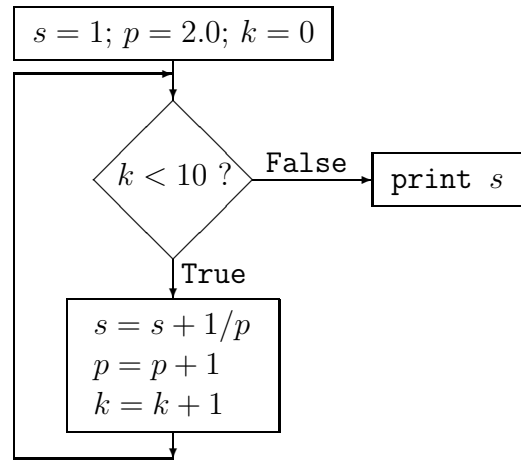
Suppose tax is computed along the following scale: for A less than \$5,000.00, the tax equals $0.5 \cdot A$, for A between \$5,000.00 and \$59,999.00, the tax equals $0.9 \cdot A$, and the tax is $0.17 \cdot A$ for A equal to \$60,000.00 and higher.

Write Python code that prints the tax with two places after the decimal point.

```
if A < 5000:
    tax = 0.5*A
elif A <= 59999.00:
    tax = 0.9*A
else:
    tax = 0.17*A
print '%.2f' % tax
```

/15

5. Consider the flowchart:



- (a) What *expression* does the algorithm in the flowchart compute?
(Do NOT evaluate the expression into one number.)

$$s = \sum_{k=0}^{10} \frac{1}{k+1}$$

- (b) Write Python code to implement the algorithm.

```

s = 1
p = 2.0
k = 0
while k < 10:
    s = s + 1/p
    p = p + 1
    k = k + 1
print s
  
```

or alternatively

```

s = 1
p = 2.0
for k in range(0,10):
    s = s + 1/p
    p = p + 1
print s
  
```

6. The 1-norm of a vector with coordinates (v_1, v_2, v_3) is $|v_1| + |v_2| + |v_3|$, where $|\cdot|$ is the absolute value function, available in Python as `math.fabs()`.

Write a Python *function* (call it `norm1`) which takes on input the coordinates of a vector and returns the 1-norm of the vector. Make sure the function works also for planar vectors, so the user can enter only two coordinates.

```
def norm1(v1,v2,v3=0):
    import math
    s = math.fabs(v1) + math.fabs(v2) + math.fabs(v3)
    return s
```

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7. Give the Python commands to generate a random 10-letter word.
Use `random.randint()` to uniformly generate letters.
The final result is a string of 10 characters.

```
import random
r = range(0,10)
u = lambda i: random.randint(ord('a'),ord('z'))
N = map(u,r)
L = map(chr,N)
s = reduce(lambda x,y: x+y,L)
```

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