

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 a register?

A register is a memory element which can be read from or written to very quickly, located in the CPU.

/10

2. View A4 as a number in the hexadecimal system. What is A4 in the decimal system?

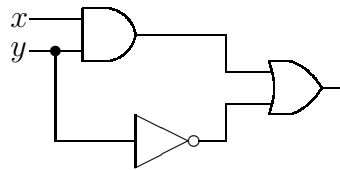
$$A_{16} = 10_{10}$$

A evaluates to 10 in the decimal system.

$$A4 = 10 \times 16 + 4 = 164.$$

/15

3. Consider the circuit drawn below:



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

(x AND y) OR NOT y

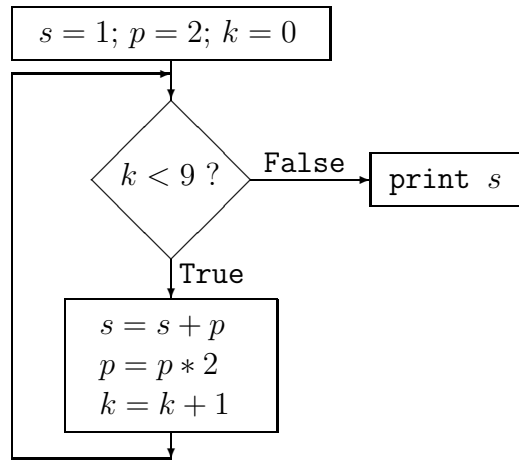
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4. Given in n is a natural number which represents time in a 24 hour format. Write Python code to print the corresponding time in AM/PM format. Some examples: 845 = 845 AM, 2045 = 845 PM, and 1221 = 1221 PM.

```
if n < 1200:
    print '%d AM' % n
elif n < 1300:
    print '%d PM' % n
else:
    print '%d PM' % n - 1200
```

/15

5. Consider the flowchart:



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

$$s = \sum_{k=0}^9 2^k$$

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

```

s = 1
p = 2
k = 0
while k < 9:
    s = s + p
    p = p * 2
    k = k + 1
print s
  
```

or alternatively

```

s = 1
p = 2
for k in range(0,9):
    s = s + p
    p = p * 2
print s
  
```

/20

6. The length of a vector with coordinates (v_1, v_2, v_3) is $\sqrt{v_1^2 + v_2^2 + v_3^2}$.

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

```
def length(v1,v2,v3=0):
    import math
    s = math.sqrt(v1**2 + v2**2 + v3**2)
    return s
```

/15

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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