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 compiler?

   A compiler is a program which translates source code into an object, an executable program, provided the source code is free of errors.

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2. View C2 as a number in the hexadecimal system. What is C2 in the decimal system?

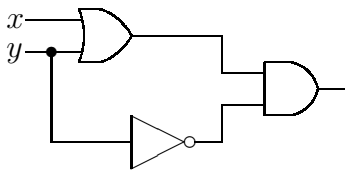
   $\mathrm{C}_{16} = 12_{10}$

   C *evaluates to* 12 *in the decimal system.*

   $\mathrm{C2} = 12 \times 16 + 2 = 194$.

/15

3. Consider the circuit drawn below:



   (a) For $x = 0$ 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 y )
```

/15

4. Given a natural number `t` representing time in minutes.

   Write Python code to print the value of `t` in days, hours, and minutes.
   The number representing the days, hours, and minutes is followed respectively by the characters `d`, `h`, and `m`.

   For example: 123 = 2h 3m, 23 = 23m, 1442 = 1d 2m.

```
(d,t) = divmod(t,1440)  # counts days in d, remainder in t
(h,t) = divmod(t,60)    # counts hours in h, remainder in t
r = ''
if d > 0: r = r + '%d' % d + 'd'
if h > 0: r = r + ' %d' % h + 'h'
if t > 0: r = r + ' %d' % t + 'm'
print r
```

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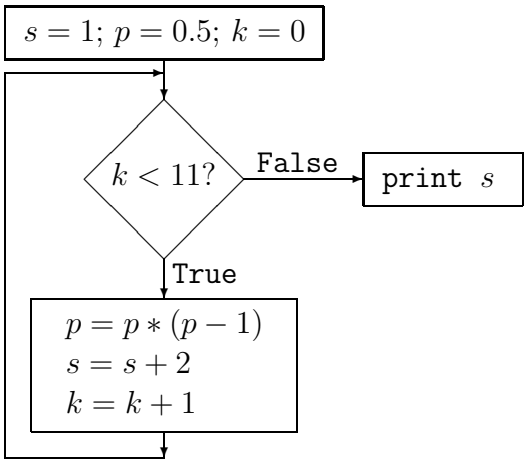
5. Consider the flowchart:



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

$$\texttt{s} = 1 + \sum_{k=0}^{11} 2$$

(b) Write Python code to implement the algorithm.

```
s = 1
p = 0.5
k = 0
while k < 11:
   p = p*(p-1)
   s = s+2
   k = k+1
print s
```

or alternatively:

```
s = 1
p = 0.5
for k in range(0,11):
   p = p*(p-1)
   s = s+2
print s
```

/20

6. Given a vector with coordinates (v_1, v_2, v_3), its product is $v_1 \times v_2 \times v_3$.

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

```
def product(v1,v2,v3=1):
   p = v1*v2*v3
   return p
```

/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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