THE UNIVERSITY OF MANITOBA

Name	Student Number

COMP1012: Computer Programming for Scientists and Engineers
Midterm In Class Exam (A01—Andres)
2012 October 23, 8:30 am — Time: 45 minutes

Instructions:

1. Answer all questions on this paper. For multiple choice questions, circle the letter of the ***best*** choice. For short answer questions, write your answer in the space provided.
2. Extra work space is available on the last page.
3. No aids (such as calculators or cell phones) are permitted.
4. You have 45 minutes to complete the exam.
5. Marks total to 16. Marks for each question are shown in the heading.

Marks for Part 1	Part 2	Part 3		Total
/ 4	/ 4	/ 8		/16

Part 1: Predict the output [4 x 1 mark]

In each row of the table below, mentally execute the code fragment on the left and enter the expected output in the box on the right. Each table row is separate. Use the space below for scrap work.

	Code Fragment	*Expected output*
A.	What is printed by `print 3. // 2 // 1**5  ?`	`1.0`

B.	What is printed by
	`print ('Sun', 'Mon', 'Tue', 'Wed',`
	`'Thu', 'Fri', 'Sat')[-5:-5]  ?`
		`()`

C.	`prices = [2.29, 0.91, 5.12, 4.89]`
	`maxPrice = prices[:1]`
	`for price in prices :`
	`  maxPrice += ( (price > maxPrice[-1])`
	`  * [price] )`
	`print maxPrice`
		`[2.29, 5.12]`

D.	`bigList = range(123456)` `print bigList.index(99)`	`99`

Work space:

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Part 2: Circle the letter of the *best* answer [5 x 1 mark]

A. After the following instructions have been executed, what is the value of `list2[1]`?

```
list1 = [6, "banana", abs, 3.0]
list2 = list1
list1[ : 2] =  [True, 17]
```

a) `6`
b) `"banana"`
c) `[True]`
d) `17`
e) none of these; `list2[1]` generates an error message

B. Which of the following choices would produce the given output?

```
Output: 6.0e-23
```

a) `print "Output: %.1e" % 6.02e-23`
b) `print "Output: %7d" % 6.02e-23`
c) `print "Output" %.1f" % 6.02e-23`
d) `print "Output:", 6.02e-23`
e) `print "Output: %7.1g" % 6.02e-23`

C. Which of the following **`for`**-loops would print the most asterisks?

a) `for jj in range(20) :  print "*",`
b) `for jj in range(1,20) :  print "*",`
c) `for jj in range(20,-1,-1) : print "*",`
d) `for jj in range(1,20,2) :  print "*",`
e) `for jj in range(-20,0) :  print "*",`

D. The two roots of the quadratic equation $ax^2 + bx + c = 0$ are given by the formula below. Which of the choices is a correct definition of a function to return the root with the positive sign, whatever the values of $a \neq 0$, b and c? Assume required imports have been done.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

a)
```
def qroots(aa, bb, cc) :
    disc = math.sqrt(bb * bb - 4 * aa * cc)
    return (-bb + disc) / 2 * aa
```

b)
```
def qroots(aa, bb, cc) :
    disc = cmath.sqrt(bb * bb - 4 * aa * cc)
    return (-bb + disc) / 2 / aa
```

c)
```
def qroots(aa, bb, cc)
    disc = cmath.sqrt(bb * bb - 4 * aa * cc)
    return (-bb + disc) / 2 / aa
```

d)
```
def qroots(aa, bb, cc) :
    disc = math.sqrt(bb * bb - 4 * aa * cc)
    return (-bb - disc) / 2 * aa
```

e)
```
def qroots(aa, bb, cc) :
    disc = cmath.sqrt(bb * bb - 4 * aa * cc)
    return (-bb + disc) / 2 * aa
```

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Part 3: Write a program [8 marks]

Write a program (that is, the contents of a script file) that evaluates the terms in the series below, using 0.5 as the value for *x*. It should collect the values of the terms in a list. It should stop evaluating terms when their value drops below 10^{-20}. Then it should sum the terms in the list in the original order, and in reverse order. It should print the values of the two sums, producing the output shown below.

Series:

$$\ln(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \ldots$$

Sample output:

```
Evaluating the series for ln(1 + x) with x = 0.5.
There are 60 terms greater than 1e-20.
Total in the original order:        0.4054651081081643
Total in reverse order:             0.4054651081081644
math.log(1+x) gives:                0.4054651081081644
```

Details:

- You do NOT need standard comments to start your program, nor termination output at the end.
- Use well-named constants or variables for values like 0.5 and 10^{-20}.

```
import math
xx = 0.5
SMALL = 1.0e-20
print "Evaluating the series for ln(1 + x) with x = %g." % xx

terms = []
term = xx
count = 0
while abs(term) > SMALL :
    terms.append(term)
    count += 1
    term = - term * xx * count / (count + 1)

print "There are %d terms greater than %g." % (count, SMALL)

total = 0.0
for term in terms :
    total += term
# alternative:  total = sum(terms)

print "Total in the original order: \t%r" % total

total = 0.0
for term in terms[-1: : -1] :
    total += term
# alternative: total = sum(terms[-1: :-1])
# alternative: total = sum(reversed(terms))
# alternative: terms.reverse() ;  total = sum(terms)

print "Total in reverse order: \t%r" % total

print "math.log(1+x) gives:    \t%r" % math.log(1 + xx)
```

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