THE UNIVERSITY OF MANITOBA | **Name** | **Student Number**

COMP1012: Computer Programming for Scientists and Engineers

Midterm In Class Exam (A01—Andres)

2015 October 29, 8:30 am — Time: 50 minutes

Instructions:

1. Answer all questions on this paper. For multiple choice questions, circle the letter of the ***best*** or most complete choice. For short answer questions, write your answer in the space provided.
2. Extra work space is available on page 3.
3. You will find a Python Guide along with your midterm; ask if you don't have one. You may ***not*** use your own copy. No other aids (such as calculators or cell phones) are permitted.
4. You have 50 minutes to complete the exam.

Marks for Part 1	Part 2A	Part 2B	Part 3	Total
/ 4	/ 4	/ 4	/ 4	/16

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

In each row of the table below, mentally execute the code 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(2 / 2 + 3 / 1) ?`
		`4.0 or 4.`
		`(0.5 for 4)`
		`Test 2 operators, precedence, type`

B.	What is printed by
	`print(tuple(range(1,-3,-2)))` ?
		`(1,-1)`
		
		`½ if [] or (1,) or (1,-1,-3)`

C.	What is printed by
	`print(1 // 4 and 1 / 4) ?`
		`0`
		`0.5 if 0.25`
		`Definition of and, bool values`

D.	What is printed by `print(2 + 1 != 1 < 2) ?`	`True`

Work space:

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Part 2: Write a program [Total 8 marks]

2. [8 marks] A friend has described to you a strange function that has this infinite series:

$$f(x) = \frac{x}{1!} - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots$$

She speculates that $f(x) \equiv \sin(x)$. Write a complete program to print out the table of values shown to the right, to compare the two functions. In evaluating the series, sum all terms that are at least 10^{-16} in absolute value and only those terms. In comparing the function values, use a comparison tolerance of 10^{-13}.

```
TESTING SIN SERIES
x[rad]    sin(x)           f(x)          Equal
0.1  0.0998334166468  0.0998334166468  True
0.2  0.1986693307951  0.1986693307951  True
0.3  0.2955202066613  0.2955202066613  True
0.4  0.3894183423087  0.3894183423087  True
0.5  0.4794255386042  0.4794255386042  True
0.6  0.5646424733950  0.5646424733950  True
0.7  0.6442176872377  0.6442176872377  True
0.8  0.7173560908995  0.7173560908995  True
0.9  0.7833269096275  0.7833269096275  True
```

```
# put imports here
import math

# global constants here
EPS1 = 1.e-16
EPS2 = 1.e-13

def main() : # put your code for the table here
    print("TESTING SIN SERIES")
    print("x[rad]    sin(x)           f(x)        Equal" )
    for num in range(1,10) :
        xx = num * 0.1
        sinX = math.sin(xx)
        seriesX = fnc(xx)
        equal = abs(sinX - seriesX) < EPS1
        print("%3g %16.13f %16.13f %5s" % (xx, sinX, seriesX,
              equal))

def fnc(xx) : # your code to return the series sum
    total = 0. # sum of terms so far
    count = 0  # number of terms included in total
    term = xx  # first term
    xSq = xx * xx # squared argument
    while abs(term) > EPS2 :
        count += 1
        total += term
        term = -term * xSq / (2 * count) / (2 * count + 1)
    return total
```

For marker use only	
Item	Mark
A	
B	
C	
D	
E	
Sum	

A. [1] import, heading
B. [1] for loop, table heading
C. [1] math.sin, fnc calls
D. [1] comparison, print result
E. bad indentation, variables

A. [1] EPS1, EPS2
B. [1] count, total, term
C. [1] while, abs
D. [1] term update, no factorial, return
E. bad indentation, variables

```
main()
```

Page intentionally left blank (apart from this line); test continues on next page

Part 3: Circle the letter of the *best* answer, or provide the required answer [4 x 1 mark]

A. Given the following lines have just been executed, which of the options below creates a list of all numbers from `seq1` that contain the digit `'3'`, and only those numbers?

```
seq1 = [-3,  4, -4, -5,  4,  0,  1, -4,  3, -3]
seq2 = []
```

a) `for num in seq1:  seq2.append((num % 3 == 0) * num)`
b) `for num in seq1:  seq2  = [num] * (num % 3 == 0)`
c) `for num in seq1:  seq2 += [num] * (num % 3 == 0)`
d) `for num in seq1:  seq2 += [num] * ('3' in str(num))`
e) `for num in seq1:  seq2  = [num] * ('3' in str(num))`

B. Which of the following does NOT print `"any_banana"` given this definition?

```
string = "any banana"
```

a) `string.replace(' ', '_'); print(string)`
b) `print(string[:3] + '_' + string[4:])`
c) `print(string.replace(" ", "_"))`
d) `print('_'.join(string.split()))`
e) `strList = list(string); strList[3] = '_'; print(''.join(strList))`

C. Which of the following statements about tuples, lists and strings is false, assuming `seq` is a tuple, a list or a string that is large enough to make the expressions valid?

a) `seq[-2]` is the second last item if `seq` is any of these data types.
b) `bool(seq[3:3])` is `False` for any of these data types.
c) `2 * seq` is twice the length of seq for any of these data types.
d) `seq[2]` is the second item if `seq` is any these data types.
e) `seq += seq` doubles the size of seq for any of these data types.

D. Using good coding practices and the same rules as QuizMaster, write a Python expression to evaluate this math expression, assuming math has already been imported:

$$\ln\left(\left\lceil \sin\left(\tan\left(\log_{10}(5) - \frac{|b|}{-5}\right)\right)\right\rceil\right)$$

Put expression here

```
math.log(math.ceil(math.sin(math.tan(math.log10(5) - abs(bb) / (-5)))))
```