DUBLIN INSTITUTE OF TECHNOLOGY
KEVIN STREET, DUBLIN 8

BSc. (Honours) Degree in Information Systems / Information Technology

Stage 1

SEMESTER 1 EXAMINATIONS 2013/2014

PROGRAMMING AND ALGORITHMS 1

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Thursday 16th January
4.00 – 6.00pm
Time Allowed: 2 hours

Answer *three* questions.
All questions carry equal marks.

1. (a) Which of the following are valid Python identifiers?

(6 marks)

```
N1
N_1
N.1
N-1
Zzzzzzz
SumUp
Good_Show
Number
NUMBER
RateOfIncrease
2Good2BeTrue
XYZ
```

(b) Convert each of the following (non-Python) expressions into Python expressions:

- 3x
- 3x + y
- x is evenly divisible by 12
- x plus 7 is more than 100 or else x is less than fifty
- $x \leq y$ and $2 \leq z$

(5 marks)

(c) Assuming num = 20, determine the value of each of the following Python expressions:

```
num / 12
123 % 100
8 + 3 * 7
(0 == 1) and (2 < 3)
not ((4.5 < 12.9) and (6 * 2 <= 13))
(0 ==1) or ( 2 < 3)
(0 == 1) or (2 < 3) and (7 < 6)
(2 < 3) or (0 == 1) and (7 < 6)
```

(8 marks)

(d) Write the output produced by this program below.

```
x = 3
if 2 > x :
    print('First')
else :
    print('Second')
    if 2 > x :
        print('Third')
    print('Fourth')
print('Fifth')
```

(4 marks)

1

(e) Write the output produced by this program below.

```
words = 'this IS NoT EvEN'
print(words.title())
print(words.replace("IS", 'was'))
print(words.upper())
print(words * 2)
```

(5 marks)

(f) Find the error in the following program.

```
line = input("Type a word")
print("You typed", line)
line = line + "h"
num = int(line)
print("You typed the number ", num)
```

(5 marks)

2. (a) In Python, what is a Function? Why have them? What is the purpose of the `return` statement? Do we have to have a `return` statement? Can a function call another function? Can a function call itself?

(9 marks)

(b) Consider the following Python program:

```
def fun(x, y):
    return x * y     # [2]

a = fun(2, 3)        # [1]
b = fun("2", 3)

print(a, b)
```

What does the function evaluate to? What would happen if we replace the last statement `print a, b` with `print a + b`?

(6 marks)

(c) Consider the following definition:

```
def fun(n, m):
    return m - n
```

Evaluate the following expressions

- `fun(fun(1, 2), 3)`
- `fun(fun(1, 2), fun(3, fun(fun(4, fun(5, 6)), 7)))`
- `fun(fun(1, 2), fun(3, fun(fun(4, fun(5, 6)), fun(7, 8))))`

What happens if in the definition of fun above we replace `return` by `print`?

2

(6 marks)

(d) Considering the following definitions:

```
def alpha(x, y):
    return x + beta(y, x)

def beta(x, y):
    return y - x    # [1]
```

What does alpha(2, 3) evaluate to?
How does the answer change if the line marked [1] is changed to return x - y?

(6 marks)

(e) Consider the following function:

```
def what(n):
    if n == 0:
        return 0
    else:
        return n + what(n-1)
```

What does it do? Whats the result returned by what(3)? What happens when we attempt to evaluate what(-3)?

(6 marks)

3. This question tests your understanding of Object Oriented Programming. The following code defines the start of a class to represent bank accounts:

```
class BankAccount(object):
    interest_rate = 0.3
    def __init__(self, name, number, balance):
        self.name = name
        self.number = number
        self.balance = balance
        return
```

(a) Name the class variables and the instance variables in the given code.

(5 marks)

(b) Add instance methods called deposit() and withdraw() which increase and decrease the balance of the account. Make sure the withdraw() method doesn't allow the account to go into overdraft. Add a third method called add_interest() which adds interest to the balance (the interest should be the interest rate multiplied by the current balance).

(14 marks)

(c) Create a subclass of `BankAccount` called `StudentAccount`. Every `StudentAccount` should have an overdraft limit of 1000. Write a constructor for the new class. Override the `withdraw()` method to make sure that students can withdraw money up to their overdraft limits.

(14 marks)

4. This question tests your ability to manipulate strings. A palindromic word is one that reads the same backwards as forwards. Hence the words hello and peel are not palindromes, but the words peep, deed and dad are palindromes.

(a) Create a class called `Palindrome`.

(3 marks)

(b) In your Palindrome class, create a method called `reverse()` which takes a string argument. Your method should return the reverse of the argument as a string. For example, if the argument is ``Foobar'' then your method should return ``rabooF''.

(10 marks)

(c) Create a second method in `Palindrome` called `isPalindrome()` which takes a string argument. This method should return `True` if the argument is a palindrome and `False` otherwise.

(7 marks)

(d) Write some code to test your new `Palindrome` class and print out results of your testing to the user. Give some consideration to what sort of strings you might want to use for your testing.

(13 marks)