

# Python for Rookies

## Example Examination Paper

### **Instructions to Students:**

- Time Allowed: 2 hours.
- This is Open Book Examination.
- All questions carry 25 marks.
- There are 5 questions in this exam. You should answer any 4 questions.

## Question 1.

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). [10 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. [10 marks]

## Question 2.

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`. [2 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`. [8 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. [5 marks]

**HINT:** Probably the easiest way to do this is to use the result of your `reverse()` method and compare the string against its reverse.

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. [10 marks]

### Question 3.

This question tests your understanding of iteration (e.g. loops and generators). Remember, you will not be marked down for small errors in syntax or typos, so long as you demonstrate that you understand how iteration works in programming languages.

a) A program to sum the number of integers from 1 to a given number  $n$ . [4 marks]

b) A program which sums the contents of a integer list or array. [5 marks]

c) Translate the following `for` loop into a `while` loop (which does the same thing as the `for` loop):

```
for i in range(1,10):  
    print "i = ", i
```

[8 marks]

d) Translate the following `while` loop into a `for` loop (which does the same thing as the `while` loop):

```
i = 20  
while (i > 0):  
    print "i = ", i  
    i -= 1
```

[8 marks]

#### Question 4.

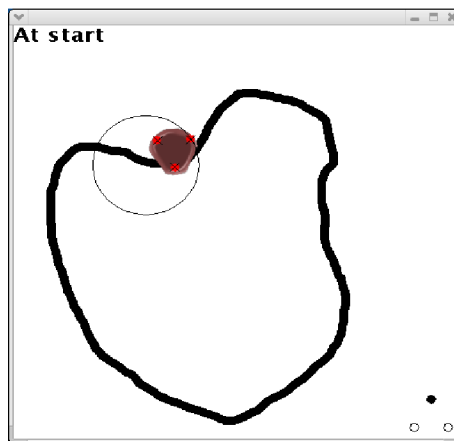
This question tests your ability to construct algorithms. Your answers can be in English, pseudo-code or Python.

You may have already used a language like Logo or the Python turtle module, which allows you to program a simple robot which can move forwards and backwards or rotate left and right. The remainder of this question requires you to consider how you might design algorithms to instruct the turtle to perform useful tasks.

a) How would you tell the turtle to move in a complete circle? [5 marks]

b) Imagine that your turtle is now equipped with sensors which can tell if they are over a white pixel or a black pixel (see the screenshot below). Your mission is to move around the screen and find a black pixel. How would you tell the turtle to do this?

More marks will be awarded for answers that cope well with difficult test cases. For example, a terrain that is all-white except for a single black pixel in a corner. [5 marks]



c) The screenshot above shows that the turtle is placed on a track. Each of the three red dots on the turtle is one of its sensors. In the picture, one sensor is over a black pixel and two are over white pixels (see the diagram on the bottom right of the screenshot). The turtle is currently at the start of the track. Describe (in English) how you would instruct the turtle to move around the track, given that it can move forwards and backwards, rotate left and right and tell whether its sensors are over black or white pixels. [15 marks]

## Question 5.

This questions tests your understanding of *recursion*, which is a fundamental concept in programming.

a) What is a *recursive* function? [2 marks]

b) The following iterative function returns the sum of all elements in a list. For example, given the list [1, 2, 3] the function will return 1+2+3 or 6. Re-write the function as a recursive function.

```
def sum(arg):
    result = 0
    for i in arg:
        result += i
    return result
```

[5 marks]

c) The following code implements a recursive function in Python called `foobar`. What does the `foobar` function do? Write a line of code which calls the `foobar` function with a suitable argument and state what the return value will be.

```
def foobar(arg):
    if arg == []:
        return arg
    else:
        return foobar(arg[1:]) + [ arg[0] ]
```

[8 marks]

d) The following code implements two *mutually recursive* functions – functions which call each other:

```
def ise(n):
    if n==0: return True
    else: return iso(n-1)
def iso(n):
    if n==0: return False
    else: return ise(n-1)
```

What will the following function calls return:

- `iso(3)`
- `iso(2)`
- `ise(3)`
- `ise(2)`

What do the functions `iso` and `ise` do?

[10 marks]