

## Programming with Python Assignment 5

### Part a. Net Present Value

Background: Net present value of a set of cashflows is the total discounted value of all flows, where each flow is discounted (divided by) the interest rate compounded by time.

Assuming cashflows occurring in year  $t$  ( $F_t$ ), and a single discount rate in decimal ( $r$ ), the present value  $P$  is given by:

$$P = \sum_t (F_t / (1 + r)^t)$$

For example, the net present value the cashflows [20, 50, 90] discounted at a rate of 5% is:

$$P = 20 / (1.05) + 50 / (1.05)^2 + 90 / (1.05)^3 = 142.14 \text{ (rounded to 2 decimal places)}$$

Assignment: Write a function `NetPresentValue( )` that takes a list of values, and an interest rate (in decimal), and returns the net present value. The list of values is assumed to be annual flows, so for example, [10, 20] represents a flow of 10 at end of year 1, and 20 at end of year 2. Zero is a valid value, so for example, [0, 20] represents no flow at the end of year 1, and a flow of 20 at the end of year 2.

Test your function with the following statements (after your function):

```
print("%.2f" % NetPresentValue([0, 100], .05)) # 2-year 0-coupon bond
```

```
print("%.2f" % NetPresentValue([4, 4, 4, 104], .05)) # 4-year bond paying 4% a year, principal+interest at maturity
```

```
print("%.2f" % NetPresentValue([], .05)) # edge case – no cashflows, should return 0
```

Name your program `LastNameFirstnameAsn5a.py` and include a first comment as: `# Firstname Lastname Assignment5A`

### Part b. Mode

Background: The mode is the value or values that occur most often in a list of numbers. Here are some examples:

List	Mode
[1,2,3,2]	[2]
[1,2,1,2]	[1,2]
[]	[]

Assignment: Write a function `CalcMode( )` that:

- 1) takes as its input argument a list of integer numbers
- 2) determines the count of each distinct value in the list
- 3) determines those values occurring the most often in the list

4) return a list result, where the list contains the values representing the mode (most often occurring values)

Test your program with these statements after your functions:

```
print(CalcMode([1, 2, 3, 2])
```

```
print(CalcMode([1, 2, 1, 2])
```

```
print(CalcMode([]))
```

Name your program LastnameFirstnameAsn5b.py and include a first comment as: # Firstname Lastname Assignment5B.

There are different ways you can structure your program to calculate the mode. Here is one suggestion.

Based on the input list of values, build a dictionary (for example, called valueCounts), that tracks each unique value and its count. The value would be the key, and the count would be its value. For example, if the input list of values were [10, 20, 30, 20, 30, 20, 20], this dictionary would ultimately look like:

valueCounts:	key	value
	10	1
	20	4
	30	2

The above dictionary could be created and returned using a function you write, findMode(list). This function could in turn use the following functions:

```
# for a dictionary of value/count pairs, find the maximum count
```

```
def findMaxCount(dict)
```

```
# for a dictionary of value/count pairs, build and return a list of values with the max count
```

```
def buildModeResult(maxcount, dict)
```