

## Assignment 1 – More Hints

### 1. Explaining the following example of the third kind of input (**Please convert \*\*\* minimally**):

```
$ python3 roman_arabic.py
```

```
How can I help you? Please convert ABCADDEFGF minimally
```

```
Sure! It is 49269 using BA_C_DEF_G
```

First, remember the two important Roman numeral rules below:

1. A Roman symbol is repeated three times but not more than that. However, the symbols **V** (5), **L** (50) and **D** (500) are never repeated.
2. The Roman symbols **V** (5), **L** (50) and **D** (500) are never written to the left of a symbol of greater value, i.e. **V** (5), **L** (50) and **D** (500) are never subtracted. The symbol **I** (1) can be subtracted from **V** (5) and **X** (10) only. The symbol **X** can be subtracted from **L** (50) and **C** (100) only.

Let us start assigning Roman numeral values from the **right-hand side** such that the value is **minimum**.

Starting with **F**, we can see it is repeated and we have to assign the minimum value to **FGF** in order to assign the minimum value to **F**. From a number of various combinations, we know that the only possible solution here is **F=10** and **G=1** (try out combinations of 1, 5, 10 here to see why this is the right one). Thus **FGF=19**.

Let us move now to the next element, which is **E**. We also need to consider the element after **E** in order to assign a smaller combination, if possible, in this case. The next element is **D**, which is repeated and therefore cannot be less than **E**. Thus, we assign **E** the smallest number not used yet, which is **50**. Moving on to **D**, since it is repeated, it cannot be greater than the next element **A**. Thus, we assign the smallest number not yet used which is **100** to **D**.

Till now, our number **DDEFGF** is resulting in **269** using **DEF\_G** (value **5** not assigned).

The next element is **A** and it is repeated. To assign a value to **A**, we must assign a value so that **ABCA** does not violate Roman numeral rules. That is,  $A < B$  and  $B > C$ . Because of **AB** (**A** and **B** being next to each other), we cannot assign **A** as 500 (500 cannot be subtracted from any number).

Let us say we assign 1000 to **A**. Then **B** can be either 5000 or 10000. **B** cannot be 5000 because that would mean **C** can only be 500. Also, **B** cannot be 10000 as it would mean **C** should be 5000 or 500 (both are invalid assignments).

Let us try to assign **10000** to **A** (it cannot be assigned 5000 since it is repeated). **B** can be either 50000 or 100000. If **B** is 50000, **C** can be either 5000, 1000 or 500. **C** cannot be 5000 or 500 (since they be subtracted from any number). **C** can be 1000.

Consequently, the smallest we can come up with here is **10000** for **A**, **50000** for **B**, and **1000** for **C**, and **ABCA = 50000 - 10000 + 10000 - 1000 = 49000**.

Thus, the total becomes **49269** using **AB\_C\_DEF\_G** (values **5**, **500** and **5000** not assigned).

## 2. More examples about the third kind of input (**Please convert \*\*\* minimally**):

```
$ python3 roman_arabic.py
```

```
How can I help you? Please convert AZERTY minimally
```

```
Sure! It is 444 using ZAREYT
```

```
$ python3 roman_arabic.py
```

```
How can I help you? Please convert XXXVVVIII minimally
```

```
Sure! It is 333 using X_V_I
```

```
$ python3 roman_arabic.py
```

```
How can I help you? Please convert AhZhJ minimally
```

```
Sure! It is 691 using Ah_Z_J
```

```
$ python3 roman_arabic.py
```

```
How can I help you? Please convert BCBC minimally
```

```
Hey, ask me something that's not impossible to do!
```