

## Fall 2020 COP 2930 Final Exam Part C Solution

**Date: 12/8/2020**

**Time Given: 11:40 am**

**Time Due: 12:40 pm**

**Late Due Time: 11:50 pm**

1) (10 pts) With potential vaccines for COVID-19 on the horizon, RNA is being discussed in the mainstream media. RNA is represented as a sequence of bases, represented as A (adenine), G (guanine), C (cytosine) and U (uracil). Thus, a strand of RNA can be represented as a string of the characters 'A', 'G', 'C' and 'U'. We can then take this string and split it into pieces, each 3 characters long. For example, the RNA strand "GCUCAAACC" can be split into the strings "GCU", "CAA" and "ACC". For this question, write a function that takes in a single string of As, Gs, Cs and Us, which is guaranteed to have a length that is a multiple of 3, and returns a list of strings, each of length 3, representing the partitioning of the string as mentioned above. The function prototype has been provided for you:

### **Sample Solution**

```
# Pre-condition: rna is a string with a length that is a multiple
#                 of 3 only consisting of the characters A,C,G,U.
# Post-condition: A list of length len(rna)//3 is returned storing
#                 the breakdown of rna into segments of strings of
#                 length 3.
def splitIntoParts(rna):

    res = []

    for i in range(0, len(rna), 3):
        res.append(rna[i:i+3])

    return res
```

**Grading: 2 pt empty list creation, 3 pts loop (can be done in many ways), 2 pts for append, 2 pts for slice, 1 pt for return**

2) (10 pts) Each string of three letters (taken from A, C, G, and U) maps to an amino acid. In fact, in many instances several different three letter strings map to the same amino acid. (For example, both "GAU" and "GAC" code for the amino acid, Aspartic acid.) Consider the problem of reading in from a text file exactly 64 lines, where each line has two space separated strings: the 3 letter RNA code, followed by the corresponding amino acid for which it codes. Write a function that takes in the file (so the file has already been opened), creates a dictionary with key/value pairs where the key is a 3 letter RNA code and the value is the corresponding amino acid, and reads in the 64 lines from the file to populate the dictionary with all of the codes, and returns this dictionary. Please complete the function below. Recall that the split() function splits a string into its separate tokens and returns a list of those tokens.

### **Sample Solution**

```
def getRNADictionary(rnafile):
    rnaDictionary = {}
    for i in range(64):
        toks = rnafile.readline().split()
        rnaDictionary[toks[0]] = toks[1]
    return rnaDictionary
```

**Grading: 2 pt empty dictionary creation, 1 pt for loop, 2 pts read, 1 pt split, 3 pts add to dictionary, 1 pt return**

3) (10 pts) Ultimately, we want to translate a string of RNA into a sequence of amino acids. Thus, if a list of 3 letter strings is given, such as ["GCU", "CAA", "ACC"], it's useful to convert this list into the following list: ["Alanine", "Glutamine", "Threonine"], since GCU codes for Alanine, CAA codes for Glutamine and "ACC" codes for Threonine. Complete the function below, so that it takes in a list of 3 letter RNA strings AND a dictionary that maps RNA strings to amino acids, and returns a list of the amino acids. Here is the function prototype with a bit of the function filled in:

### **Sample Solution**

```
def getAminoAcidList(rnalist, rnadictionary):
    aaList = []
    for i in range(len(rnalist)):
        aaList.append(rnaDictionary[rnalist[i]])
    return aaList
```

**Grading: 2 pt empty list creation, 2 pts loop, 2 pts access rnalist, 2 pts use that as index to dictionary, 1 pt append to list, 1 pt return**

4) (5 pts) When working with a dictionary, what is a KeyError? Give a short example of code which would cause a KeyError.

### **Sample Solution**

A key error is when you index a dictionary with a key that does not exist in the dictionary. Here is a short example that causes a KeyError:

```
mydictionary = {}
mydictionary["apple"] = 25
print(mydictionary["orange"])
```

In this example, there is only one valid key to mydictionary, "apple". If I try to index it with anything else, in this case, "orange", I get a KeyError since there is no value mapped to "orange".

**Grading: 3 pts for explanation, 2 pts for example**

5) (5 pts) Which cute animal does the restaurant Panda Express have on its logo? **Panda**

**Grading: Give to All**