

Tutorial 7: While Loops

Due: Friday, March 20, 2020

1: Scanning Documents

A university allows you to scan documents for 5 cents per page. Write a program for the scanner that asks the user if they would like to scan a page. If the user enters “yes”, the program should output the subtotal of the cost. If the user enters “no” the program should output the total cost of the document.

Example:

```
Would you like to scan a page (yes/no)? yes
Subtotal: $0.05
Would you like to scan another page (yes/no)? yes
Subtotal: $0.10
Would you like to scan another page (yes/no)? no
Total: $0.10
```

2: Craps

Craps is a dice game played at many casinos. A player rolls a pair of normal six-sided dice. If the initial roll is 2, 3, or 12, the player loses. If the roll is 7 or 11, the player wins. Any other initial roll causes the player to “roll for point.” That is, the player keeps rolling the dice until either rolling a 7 or re-rolling the value of the initial roll. If the player re-rolls the initial value before rolling a 7, it's a win. Rolling a 7 first is a loss.

Write a program to simulate multiple games of craps and estimate the probability that the player wins. For example, if the player wins 249 out of 500 games, then the estimated probability of winning is $249/500 = 0.498$.

3: Valid DNA Codons

Proteins are composed of sequences of amino acids. DNA contains information about how to build proteins by encoding for amino acids. Every 3 letter subsequence, or **codon**, of DNA encodes for one amino acid. For example, ACA is Threonine, and AGA is Arginine. Therefore, the DNA sequence ACA AGA AGA would encode for the amino acid sequence: Threonine-Arginine-Arginine.

a) Write a function that returns **True** if a string parameter is a valid codon. A valid DNA codon has 3 letters, that must be either A, G, T, or C. For example, the strings “ATG” and “GCC” are valid codons and “AC” and “ABC” are invalid codons.

b) Write a program that asks a user for a DNA codon. Use a **post-test loop** to ensure that the user has entered a valid codon. If the codon is invalid, prompt the user to try again.

4: Start and Stop Codons

In a DNA sequence, the start codon and stop codon indicate the beginning and end of the protein. The **start codon**, ATG, allows enzymes to start making a protein. ATG encodes for the amino acid methionine, therefore the first amino acid in a nascent protein chain will always be methionine. One of three possible **stop codons**: TAG, TAA, and TGA indicates that the protein is finished. The stop codons do not code for amino acids. For example, the sequence ATGACAAGAAGATAG encodes for four amino acids.

a) What programming concept are the stop codons analogous to? Briefly explain.

Hint: review the three types of while loops.

b) Write a program that can analyze a long string of DNA and determine how many amino acids are in the relevant protein it encodes.

Hint: You can test the program using the following DNA sequence:

```
seq='ACCAAGATGCCATTGTCCCCGGCCTCCTGCTGCTGCTGCTCTCCGGGGCCACGGCCACCGCTGCCCTGCC'\
'CCTGGAGGGTGGCCCCACCGGCCGAGACAGCGAGCATATGCAGGAAGCGGCAGGAATAAGGAAAAGCAGC'\
'CTCCTGACTTTCCTCGCTTGGTGGTTTGAGTGGACCTCCCAGGCCAGTGCCGGGGCCCTCATAGGAGAGG'\
'AAGCTCGGGAGGTGGCCAGGCGGCAGGAAGGCGCACCCCCCAGCAATCCGCGCGCCGGGACAGAATGCC'\
'CTGCAGGAACTTCTTCTGGAAGACCTTCTCCTCCTGCAAATAAACCTCACCCATGAATGCTCACGCAAG'\
'TTTAATTACAGACCTGAA'
```