Homework 5
CS 181, Fall 2017

**Out:** Nov. 16
**Due:** Nov. 30, 11:59 PM

Please print your answers and place them in the CS1810 homework bin on the 2nd floor of the CIT. You can use \LaTeX or a word document to write up your answers, but we prefer you use \LaTeX. You may scan hand-written work or images for parts of solutions only if they are extremely clean and legible. Please put your Banner ID on the top of each page of your homework. Please ensure that your name does not appear anywhere on the paper you hand in.

**Problem 1: HMM - Viterbi**

A HMM has been constructed to generate a sequence, \( x \), of symbols consisting of 2 states. Each time the Markov chain visits a state, one symbol (A, T, C, or G) is generated. In state 1, symbol A is generated with probability 0.1, symbol T with probability .2, symbol C with probability .2, and symbol G with probability .5. In state 2, symbol A is generated with probability 0.3, symbol T with probability .2, symbol C with probability .3, and symbol G with probability .2. The Markov chain jumps from state 1 to state 2 with probability 0.3, and from state 2 to state 1 with probability 0.2. The initial probability distribution is 0.5 for state 1 and 0.5 for state 2.

Calculate the most likely sequence of states using the Viterbi algorithm for ATCAG. Show your work.

**Problem 2: HMM - Forward Algorithm**

Use the forward algorithm to determine the probability that the sequence ATCAG was generated by an HMM according to the emission and transition probabilities listed in Problem 1. Show your work.