CSC 314, Bioinformatics Lab #4 **Name:**_____
Gene Expression Lab, Spring 2020

Use the genetic code (on page 12 of the Gene Expression notes) to answer the following questions. To answer these correctly, it is important to understand the following:

1. the difference between the DNA **template (anti-sense) strand** and the DNA **sense strand,**
2. during transcription, the DNA *template* strand is read from the 3' to 5' direction in order to produce a mRNA molecule from its 5' to 3' end. The mRNA molecule will be identical to the *sense* strand except *U* replaces *T* in mRNA.
3. translation produces a polypeptide by reading a mRNA from its 5' to 3' end.

Assume that unless otherwise indicated, DNA sequences do *not* contain introns. Note that for this exercise, not all transcripts will begin with a start codon, or end with a stop codon. However, translation should stop (no more amino acids are produced) when a stop codon is present, and "translation" of a stop codon should be indicated with an **X**.

Note: You may use a translation tool such as http://web.expasy.org/translate/ to check your work, though **your answers must use the 3 letter amino acid abbreviation codes** (http://www.ddbj.nig.ac.jp/sub/ref2-e.html). Note that the Expasy tool translates DNA *sense* strands and mRNA sequences only. Also, note that you will be asked to complete similar questions using only the Genetic Code table on the 1st exam.

1. What is the amino acid sequence of the polypeptide produced from translation of the following mRNA molecule?

   5' — AUGAUUCCAUAUUGA — 3'

2. What is the mRNA sequence and amino acid sequences of the polypeptide produced following transcription and translation of the DNA sequence on the *sense* strand of the DNA molecule?

   5' — ATGATTCATAGA — 3'

3. What is the mRNA sequence and amino acid sequences of the polypeptide produced following transcription and translation of the DNA sequence on the *sense* strand of the DNA molecule? **Hint**: remember that the mRNA is produced from its 5' to 3' end.

   3' — TACAGTCCATTTGTA — 5'

4. What is the mRNA sequence and amino acid sequences of the polypeptide produced following transcription and translation of the DNA sequence on the *template* strand of the DNA molecule?

   5' — GTATTAGCCAGGCAT— 3'

5. What is the mRNA sequence and amino acid sequence of the polypeptide produced from the following DNA sequence on the *sense* strand of the DNA molecule, with exons and introns as indicated?

Exon	intron	exon	Intron	Exon
5' —ATGA	ACGATG	AGGAA	TTGACTATGTCA	GAGTGA— 3'

6. Consider the DNA sequence on the sense strand

   5' – ATGTGTCACAACGAGTGA – 3'

   that will express the following polypeptide:

   Met-Cys-His-Asn-Glu-X

   The DNA sequences below each contain a mutation relative to the above sequence. Identify the *type(s)* of mutations (silent, missense, nonsense, insertion, deletion, frameshift) and the polypeptide sequence that will be produced.

a. `wild-type sequence:  5' – ATGTGTCA**C**AACGAGTGA – 3'`
   `mutated sequence:    5' – ATGTGCCA**A**AACGAGTGA – 3'`

b. wild-type sequence: 5' – ATGTG**T**CACAACGAGTGA – 3'
mutated sequence: 5' – ATGTG**C**CATAACGAGTGA – 3'

c. wild-type sequence: 5' – ATGTG**T**CACAACGAGTGA – 3'
mutated sequence: 5' – ATGTG**A**CACAACGAGTGA – 3'