TTIC 31190: Natural Language Processing – Prerequisite Quiz

Name: _____ CNetID: _____ Officially Enrolled? (Y/N) _____

This quiz will not affect your grade in the course.

Problem 1 (40 pts) A bag contains 3 red balls and 2 blue balls. All balls have the same probability of being drawn. Please beiefly explain your answer for each case.

1. (10 pts) We draw a ball from the bag. What is the probability that the ball is red?

2. (15 pts) We draw a ball from the bag. Without putting back the first ball, we draw another ball from the bag. What is the probability that the second ball is red, if the first ball is red?

3. (15 pts) We draw a ball from the bag. Without putting back the first ball, we draw another ball from the bag. What is the probability that the second ball is red, no matter what the color of the first ball is?

Problem 2 (40 pts) We have a function $f(x), x \in [-10, 10]$. For the following cases, what value of x minimizes $f(x)$? What is the minimum value of $f(x)$? Please briefly explain your answer.

1. (15 pts) $f(x) = x$

2. (15 pts) $f(x) = x^2 - 2x + 1$

3. (10 pts) $f(x) = -\log(|x - 1|)$

Problem 3 (20 pts) What is the time complexity of the following algorithm, in terms of n? Please explain your answer.

```
def foo(a: list[int]):
    n = len(a)
    b = list()
    for i in range(n): # enumerate all elements in a
        while len(b) > 0 and b[-1] >= a[i]: # compare the last element in b with a[i]
            b.pop() # remove the last element with O(1) complexity
        b.append(a[i]) # append a[i] to the end of b with O(1) complexity
    return b
```