CIS 5526 Pretest **08/25/2022**

ALGEBRA:

1. $\sum_{i=1}^{5}(i-1) =$

2. $\sum_{i=1}^{1000} i =$

CALCULUS:

1. $g(x) = abs(x)$. What is the first derivative $g'(4)$?

2. What is $g'(0)$ for $g(x) = \sin(3x^2+x)$?

3. $f(x) = x^2 - 2x + 1$. Find x where $f(x)$ has the minimum value.

4. What is the limit of the following function when n becomes very large: $\lim_{n\to\infty} \frac{6n\cdot logn+3n^2+128n+3456}{12n^2+8logn}$

5. $f(x,y) = x^2 + 3xy + x\cos(x+y)$. What is the partial derivative $\frac{\partial f(x,y)}{\partial x}$? What is the gradient $\nabla f(0,0)$?

LINEAR ALGEBRA:

1-6. $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \end{bmatrix}$. What is:

A·B = B·B = A^T·A =

rank(B) = *inv*(A) = A^{-1} = *inv*(B) = B^{-1} =

7. What is a norm (2-norm) of vector x = [1 1]?

PROBABILITY and STATISTICS:

1. X is a uniformly distributed random variable from range [0, 1], X ~ uni(0,1). In other words, this distribution is generating numbers larger than 0 and smaller than 1 at random. What is P(X > 0.8)?

2. $X \sim N(\mu,\sigma)$: X is Gaussian random variable with mean μ and standard deviation σ. What is E(X) and what is $E(X^2)$?

3. X and Y are numbers obtained by 2 dice thrown at the same time. What is P(X + Y = 6) ?

4. What is the Central Limit Theorem?

5. What is the correlation coefficient and how it is defined?

PROGRAMMING and ANALYSIS OF ALGORITHMS:

1. Write code in any programming language (if you do not know, then write pseudocode) of an algorithm that finds sum of all positive elements in a list of size n. What is the big-Oh for the number of operations by this algorithm?

2. Write a line of code in python that creates a dictionary object (any dictionary object is fine)

3. You are given the following pseudocode. What is the big-Oh time complexity of this code as a function of n?

```
i = n      // n is any number larger than 1
while i>1
        i = i/4
```

4. An algorithm has time cost O(sqrt(n)). If it takes a computer 3 seconds to run the algorithm for n=10, how much time it would take for n = 1000?