Assignment #1

CSE230

Last Date: 3 April 2021, Saturday, 9 PM

1 Format

You need to show how you derived the solutions. Submit your answers in a single PDF file within Saturday, 3 April 2021, 9 PM. You can mail submit them through the Google Form Link on buX.
The file's name should be "CSE230-Assignment1-Section-ID-Name.pdf". For example, if your name is Brad Pitt, your ID is 81810022, and your section is Section 5, your file's name should be "CSE230-Assignment1-Section5-81810022-BradPitt.pdf". Please follow this carefully, otherwise, we may not be able to find your submission.

2 Problems

2.1

Find the Domains and the Ranges of the following functions:

1. $f: R \to R,\ f(x) = sin(x)$
2. $f: R \to R,\ f(x) = tan(x)$
3. $f: R \to R,\ f(x) = sin(x) + cos(x)$
4. $f: R \to R,\ f(x) = \frac{sin(x)+cos(x)}{1-x^2}$
5. $f: R \to R,\ f(x) = \frac{1}{x^2-2}$
6. $f: R \to R,\ f(x) = 3 - log(1 + x^2)$
7. $f: R \to R,\ f(x) = 8 + log(1 - x^2)$
8. $f: R \to R,\ f(x) = x^2 - log(1 + x^2)$
9. $f: R \to R,\ f(x) = \frac{1}{log(1-x^2)}$
10. $f: R \to R,\ f(x) = \frac{1}{1-x^2}$

2.2

Find out if the following functions are injections, surjections, or bijections:

1. $f: R \to R$, $f(x) = \frac{x+1}{x+5}$
2. $f: R \to R$, $f(x) = \frac{x^2+1}{x^2+5}$
3. $f: R \to R$, $f(x) = x^7 + x^3$
4. $f: R \to R$, $f(x) = x^7 + x^4$
5. $f: R \to R$, $f(x) = \frac{1}{log(x)-1}$
6. $f: R \to R$, $f(x) = e^{3x}$

2.3

How many integers between 0 and 500:

1. Have distinct digits?
2. Are divisible by 3?
3. Are divisible by 3 or 5?
4. Are divisible by either 3 or 5, but not both?
5. Are divisible by 3, but not 5?

2.4

How many diagonals does a 12-sided convex polygon have? What is the general rule for a convex polygon with n sides?

2.5

How many ways are there to arrange the letters m, n, o, p, and q such that neither m nor n is followed immediately by o?

2.6

Suppose that a password for a locked door must have at least 8 characters, where each character in the password can be a lowercase English letter, an uppercase English letter or a digit. Now imagine that a hacker is watching an user insert the password, and based on the time it took to insert the password, it cannot have been more than 11 characters long. Now,

1. How many passwords can there be for this locked door?
2. If the hacker can try a million (10^6) permutations at the locked door in every second, how long will it take the hacker to try all the possible passwords?

2.7

Officially, variable names in Python can be any length and can consist of uppercase and lowercase letters (A-Z , a-z), digits (0-9), and the underscore character (_). An additional restriction is that, although a variable name can contain digits, the first character of a variable name cannot be a digit.
Python's most followed style guide, PEP8 also suggests us to limit each line to 79 characters, so, to be extra careful, we will assume variables can be of at most 7 characters in length.
Now, the question is, how many variable names can there be in Python if we abide by these two rules?

2.8

A coin is flipped 10 times where each flip comes up either heads or tails. How many possible outcomes

1. Contain no heads?
2. Contain exactly three heads?
3. Contain at least three heads?
4. Contain more heads than tails?

2.9

What is the coefficient of x^{28} in $(2x^3 - x)^{16}$?

2.10

What is the coefficient of x^2 in $(3x - \frac{2}{x^2})^{23}$?

2.11

How many solutions are there to the equation: $x_1 + x_2 + x3 = 19$ where

1. x_1, x_2, x_3 are all non-negative integers?
2. x_1, x_2, x_3 are all positive integers?

2.12

How many different strings can be made from the letters in $ATTRACTION$, using all the letters, if all three Ts must be separated from each other by at least one character?

2.13

Jiminy Cricket is going from (0,0) to (10,6) by hopping either right or up. Jiminy cannot move leftwards or downwards, and can only go one step at a time in the 2-D space. How many ways can Jiminy go from (0,0) to (10,6)?

2.14

There are 32 different cards in a deck for playing Twenty-Nine. The cards are distributed equally among four players. How many ways are there to distribute these cards?