CSCI 150 Discrete Mathematics
Practice 1

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Problem 0
Read chapter 0.

Problem 1: Practice sum and product notation
Mathematical notation is important for conveying mathematical ideas. For instance, consider the sum of the first n positive integers. This can be written as $1+2+3+\ldots+n$. More concisely, we can also express this using the summation notation:

$$\sum_{i=1}^{n} i$$

For each of the following, provide two ways of expressing it similar to the example given above:

- the sum of the first n positive odd numbers.
- the product of the first n positive even numbers.
- the sum of the first n positive perfect squares.
- the equivalent of s in the following C++ program:

```
//assume n is given
int s=0;
for (int i=1; i<=n; i++) {
  s=s+i*(n-i+1);
}
```

Problem 2: Series

(a) Find the 168^{th} term of the sequence

$$68, 79, 90, \ldots, 2257$$

(b) A triangle is made out of a row of 100 stars, followed by a row of 97 stars, followed by a row of 94 stars, and so on. Write a formula for the total number of stars using Σ notation, and evaluate it.

(c) Find $\sum_{i=10}^{20}(i-15)$.

Problem 3: Graphs, degrees, edges
Explore the following. You only need to know what a graph is and the definition of the degree of a vertex (covered in class).

(a) Is it possible to come up with two graphs that have the same number of edges but different set of degrees? If yes, show an example, if no, explain why.

(b) Is it possible to come up with two graphs that have the same set of degrees but different number of edges? If yes, show an example, if no, explain why.

Problem 4: Permutations
Watch this video:

`https://artofproblemsolving.com/videos/prealgebra/chapter14/181`

This explains why the number of permutations on n objects is equal to $n! = n(n-1)(n-2)\dots 1$. We will cover a general principle known as the multiplication rule in class.

Problem 5: Snakes and Ladders
Use the approach we have seen in class to determine the following:

(a) In how many ways can we place one snake and one ladder on a grid with n squares?

(b) In how many ways can we place two snakes on a grid with n squares?

(c) Verify your answers (in terms of n) for the case of a 2×2 grid, i.e. when $n = 4$, by enumerating all possibilities.