Homework #0

Your Name and Student ID

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Classmate collaborator(s): If you collaborated with fellow students, you *must* list them here.

1 First Problem

Solution. Write your solution here. You insert math into a sentence using the dollar sign, like this: $f(x) = 2x$. Sometimes you need an entire line for an equation, so you use the equation environment, like this:

$$2^{n+1} = \sum_{i=0}^{n} 2^i$$

If you wish to define an equation that spans multiple lines, use the align environment, like this:

$$\begin{aligned} 1 + 2 + 2^2 + \ldots + 2^{k+1} &= (1 + 2 + 2^2 + \ldots + 2^k) + 2^{k+1} \\ &= 2^{k+1} - 1 + 2^{k+1} \\ &= 2 \cdot 2^{k+1} - 1 \\ &= 2^{k+2} - 1 \end{aligned}$$

If you wish to define a function with cases, use the cases environment, like this:

$$f(n) = \begin{cases} n & \text{if } n \text{ is even} \\ -n & \text{if } n \text{ is odd} \end{cases}$$

2 Second Problem

Solution. Sometimes you will want to write proofs. Use the proof environment, like this:

Proof. Suppose that $f : A \to B$ and $g : B \to C$ are injective. Suppose that $x, y \in A$ and $x \neq y$. Then $f(x) \neq f(y)$ because f is injective. Similarly, $g(f(x)) \neq g(f(y))$ because g is injective. Therefore $g \circ f(x) \neq g \circ f(y)$ whenever $x \neq y$, so $g \circ f$ is injective. □

Sometimes you will want to write algorithms. Use the algorithmic environment, like this:

Algorithm 1 YourAlgorithm(A, B)

```
for i = 1 to n do
    if A[i] > B[i] then
        A[i] is bigger!
    else
        A[i] is not bigger!
    end if
end for
return True
```

Sometimes you will want to use tables. Use the tabular environment, like this:

a	b	10
e	2	d

The argument after the beginning of tabular specifies the columns. l for left justification, c for centered, r for right justification. The bar | creates a vertical line in the table. \hline creates a horizontal line in the table.

3 Third Problem

Here is a brief, incomplete list of useful math symbols etc.

1. Exponential $\exp n$, e^n, 2^n etc.
2. Logarithm log
3. Big-O $O(f(n))$, Big-Omega $\Omega(f(n))$, Big-Theta $\Theta(f(n))$
4. Summation $\sum_{i=1}^{n} i$
5. Function $f : A \to B$
6. Union $A \cup B$, Intersection $A \cap B$, Complement $\overline{A}$, Set Difference $A \setminus B$
7. Set membership $x \in A$

8. Power Set $\mathcal{P}(A)$