## Sayan Chaudhry, Deepayan Patra

07-131: Section A Professor: Cortina September 15, 2020

# 07-131 Homework 3

#### Problem 1 Math

LaTeX is a wesome for math! Let's look evaluating the value of m if  $(m+2)\times(3+4)=21$  in two ways. Using the initial equality:

$$(m+2) \times (3+4) = 21 \qquad (start)$$

$$\implies (m+2) \times 7 = 21 \qquad (evaluating 3 + 4 = 7)$$

$$\implies m+2 = \frac{21}{7} \qquad (dividing by 7 on both sides)$$

$$\implies m+2 = 3 \qquad (evaluating  $\frac{21}{7} = 3$ )$$

$$\implies m = 3-2 \qquad (subtracting 2 on both sides)$$

$$\implies m = 1 \qquad (evaluating 3 - 2 = 1)$$

Therefore:

m = 1

\*

Using the initial equality:

$$(m+2) \times (3+4) = 21 \qquad (start)$$

$$\implies (m+2) \times 7 = 21 \qquad (evaluating 3+4=7)$$

$$\implies (m \times 7) + (2 \times 7) = 21 \qquad (using distributive property)$$

$$\implies (m \times 7) + 14 = 21 \qquad (evaluating 2 \times 7 = 14)$$

$$\implies m \times 7 = 21 - 14 \qquad (subtracting 14 on both sides)$$

$$\implies m \times 7 = 7 \qquad (evaluating 21 - 14 = 7)$$

$$\implies m = \frac{7}{7} \qquad (dividing by 7 on both sides)$$

$$\implies m = 1 \qquad (evaluating \frac{7}{7} = 1)$$

Therefore:

m = 1

## Problem 2 Induction

Induction becomes so much easier with LaTeX! Take a look:

#### Problem 2 Calculus

Those of you who enjoy calculus will have a blast!

Find  $\lim_{x\to 2} \frac{x^2 + x - 6}{x^2 - 4}$ .

$$\lim_{x\to 2} \frac{x^2+x-6}{x^2-4} = \lim_{x\to 2} \frac{2x+1}{2x}$$
 (by L'Hôpital's Rule) 
$$= \frac{5}{4}$$

Another one? Ok!

Given  $f(x,y) = \frac{xy}{x+y}$  if  $(x,y) \neq (0,0)$  and f(0,0) = 0.

For  $(x, y) \neq (0, 0)$ ,

$$\frac{\partial f}{\partial x}(x,y) = \frac{\partial}{\partial x} \left(\frac{xy}{x+y}\right)$$
 (by substitution)
$$= \frac{y(x+y) - xy(1)}{(x+y)^2}$$
 (by differentiation rules)
$$= \frac{y^2}{(x+y)^2}$$

and

$$\frac{\partial f}{\partial y}(x,y) = \frac{\partial}{\partial y} \left(\frac{xy}{x+y}\right)$$
 (by substitution)
$$= \frac{x(x+y) - xy(1)}{(x+y)^2}$$
 (by differentiation rules)
$$= \frac{x^2}{(x+y)^2}$$

Alright, no more problems. Just two more equations.

$$\iiint_{V} (\nabla \cdot \mathbf{F}) \, dV = \oiint_{S(V)} \mathbf{F} \cdot \hat{\mathbf{n}} \, dS$$

$$\iiint_{V} (\nabla \times \mathbf{F}) \, dV = \oiint \hat{\mathbf{n}} \times \mathbf{F} \, dS$$

#### **Problem 3** Programming

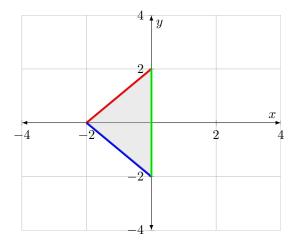
#include < stdio.h>

You can code in LaTeX too! Here's an intro to typesetting programs:

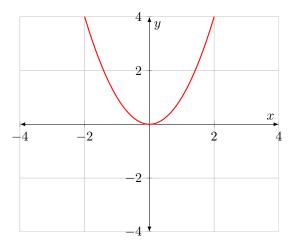
```
#include < iostream >
  // My first program
  int main(void)
    printf("Hello World\n");
    return 0;
  }
You can also change languages really easily, like here:
  (* My second program *)
  fun map f xs = let
    fun m ([], acc) = List.rev acc
      \mid m (x::xs, acc) = m (xs, f x::acc)
    in
      m (xs, [])
    end
or here:
  # My third program
  def UncommonWords(A, B):
    # count will contain all the word counts
    count = {}
    # insert words of string A to hash
    for word in A.split():
      count[word] = count.get(word, 0) + 1
    # insert words of string B to hash
    for word in B.split():
      count[word] = count.get(word, 0) + 1
    # return required list of words
    return [word for word in count if count[word] == 1]
```

# Problem 4 Graphing

Plotting in Latex is super fun! Here's a mini graph with some shading:



and here's a plot of  $y = x^2$ :



## Problem 4 Images

You can make some really pretty images and figures in LaTeX too!

# Carnegie Mellon University

Figure 1: CMU

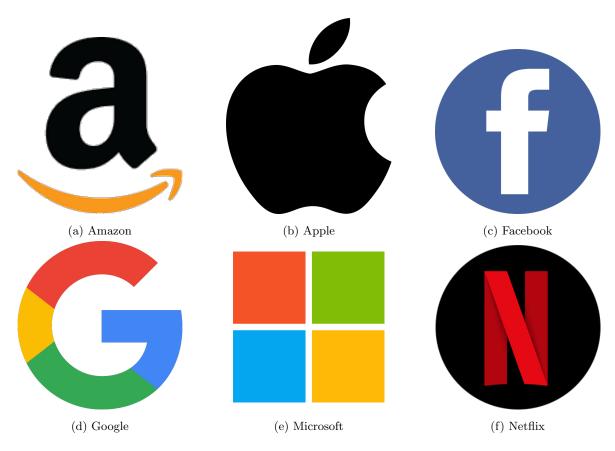


Figure 2: FAANG logos

and can reference back to them! Take me to FAANG logos or take me to CMU.