SSIE-500: Homework 1

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Abstract

This is an abstract of my Document.

1 LaTeX

The screen shot in **Figure** 1 contains the markup of a document that was created in TeXworks that is installed on my local machine. The document that you're reading now was created using Overleaf and so what is provided below has been rendered from the LaTeX syntax and represents a calculation from a past linear algebra class. Please see **Equation** 1.

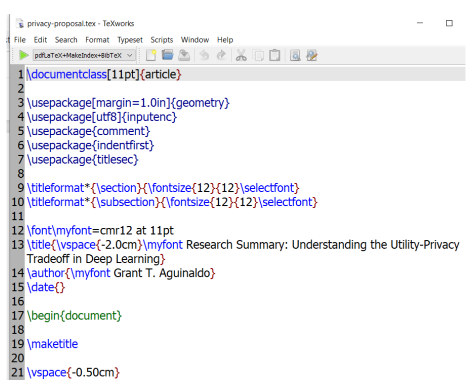

Figure 1: Figure of Two Logos Placed Side-by-Side.

Solve by setting the set of vectors equal to 0 and solving for a_1, a_2, a_3.

$$a_1(x^2) + a_2(x^2 - x - 1) + a_3(x + 1) = 0 \tag{1}$$

From this, we find that, $a_1 = 0, a_3 - a_2 = 0$. Since we have $a_3 = a_2$, we have a dependency in the set of vectors. If we remove the term $a_3(x + 1)$ from the set of vectors, we are able to solve for $a_1 = 0$, and $a_2 = 0$. Given that the $dim(A) = 2$, A spans $\mathbb{R}^2$.

1.1 More Typesetting of Math Functions

In this section, I will typeset mathematical functions. Provide a proof of the following relationship:

$$k\binom{n}{k} = n\binom{n-1}{k-1} \tag{2}$$

Proof: Consider the following relationships:

$$\binom{n}{k} = \frac{n!}{(n-k)! \cdot k!} \tag{3}$$

$$n! = n \cdot (n-1)! \tag{4}$$

Now consider the left hand side (LHS) of **2**

$$LHS = k\binom{n}{k} = \frac{k \cdot n!}{(n-k)! \cdot k!} = \frac{\cancel{k} \cdot n!}{(n-k)! \cdot \cancel{k}(k-1)!} = \frac{n!}{(n-k)! \cdot (k-1)!} \tag{5}$$

Now consider the right hand side (RHS) of **2**

$$RHS = n\binom{n-1}{k-1} = \frac{n \cdot (n-1)!}{(n-k)! \cdot (k-1)!} = \frac{n!}{(n-k)! \cdot (k-1)!} \tag{6}$$

Since the LHS is equal to the RHS, this concludes the proof.

1.1.1 Hoeffding's Inequality

In this section of the document, I will type set another mathmatical relationship that is common in machine learning.

$$\mathbb{P} = (|\nu - \mu| > \epsilon) \leq 2 \cdot \exp(-2e^{-2\epsilon^2 N}) \quad \forall\, \epsilon > 0 \tag{7}$$

In words, **Equation** 7 represents the the probability ($\mathbb{P}[\cdot]$), that the event ν will deviate from some value μ by a value that exceeds a tolerance ϵ, is a function of the sample size, N under consideration.[1]

[1] See page 16 of http://work.caltech.edu/slides/slides02.pdf

2 Python, Jupyter Notebook

A screen shot in **Figure** 2 contains sample code that was written in a Jupyter Notebook. In this screen shot, I am making a Data Frame using the `Pandas` library. The version of Python and Anaconda that is installed on a local machine is shown below in **Figure** 3. The version of Python that I am using is `Python 3.8.3`. I am also using version `1.7.2` for by distribution of Anaconda. The screen shot in **Figure** 3 is showing the version of `Python` and `Anaconda` that I have installed on my machine.

In [1]:
```
import pandas as pd
import numpy as np

df = pd.DataFrame({'document_name': ['doc1', 'doc2', 'doc3', 'doc4', 'doc5', 'doc6'],
                  'document_relevance': [3, 2, 3, 0, 1, 2]})
df
```

Out[1]:

	document_name	document_relevance
0	doc1	3
1	doc2	2
2	doc3	3
3	doc4	0
4	doc5	1
5	doc6	2

Figure 2: Screen Shot of sample code that was written in Jupyter Notebook.

```
(ssie500) C:\Users\Grant_Aguinaldo\Desktop\ssie500>python --version
Python 3.8.3

(ssie500) C:\Users\Grant_Aguinaldo\Desktop\ssie500>anaconda --version
anaconda Command line client (version 1.7.2)

(ssie500) C:\Users\Grant_Aguinaldo\Desktop\ssie500>
```

Figure 3: Screen Shot of Command Line Showing Python Version.

3 Julia

A screenshot of some Julia code that was written in a Jupyter notebook is shown below in **Figure** 4. In this screenshot, I am simply printing a string to the Jupyter Notebook using the `Julia` syntax.

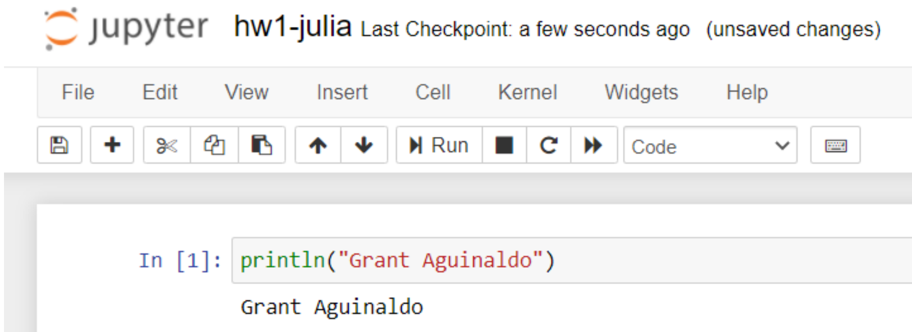

Figure 4: Screen Shot of Julia Syntax in a Jupyter Notebook.

4 Mathematica

A screen shot in **Figure** 5 of code that was written in Mathematica is below. The code below is seeks to compute the following indefinite integral shown in **Equation** 8.

$$I = \int cos(x)e^{2x}dx \tag{8}$$

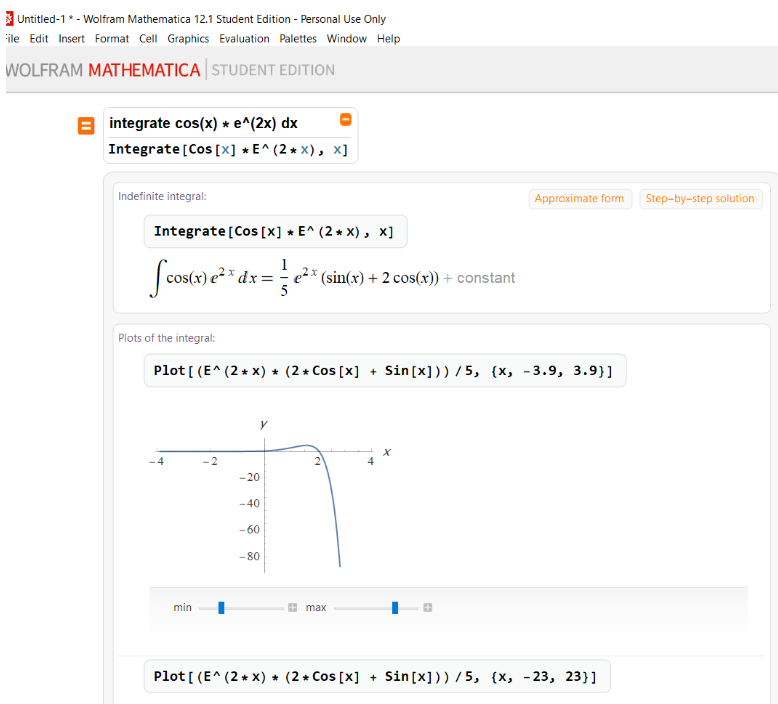

Figure 5: Screen Shot of an Example Calculation in Mathematica.

A This is the Appendix A of my Document

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B This is the Appendix B of my Document

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