Technical Typesetting Assignment

Your Name

Submission Date

Contents

This is an assignment. Here's what you have to do. The first page should contain the title and table of contents. Then, you must replicate the next three pages as closely as possible. To help you get started, here's the document class and list of packages we used:

```
\documentclass{article}

\usepackage{listings}
\usepackage{xcolor}
\usepackage{amsmath}
\usepackage{amsthm}
\usepackage{amssymb}
\usepackage{esint}
\usepackage[parfill]{parskip}
\usepackage{hyperref}
\usepackage{floatrow}
\usepackage{graphicx}
\usepackage{multirow}
\usepackage{multicol}
```

We have provided the the required images. **To clarify, you don't need to copy the instructions on the first page in your submission; your first page should only consist of the title and table of contents.**

Good luck!

1 Listings and Environments

Listing 1: [LaTeX]TeX
An Example

```
\begin{lstlisting}
%A regular \lstlisting environment won't work. You'll have to use \lstnewenvironment to define a custom environment.
\end{lstlisting}
```

Listing 2: Python
Regular Stuff

```
from scipy import *
#The custom environment you define should be numbered as well. We did this in our tutorial. Think about what arguments you can pass to it.
print("Hello!")
```

Listing 3: C++
Generic Title

```
#include <iostream>
using namespace std;

//From the three examples, you must have observed what you can hardcode.

int main(int argc, char* argv[])
{
    cout<<"Hello!"<<endl;
}
```

The `2em` vertical space after the listing is part of the custom environment.

2 Formal Logic: Figures and Tables

Figure 1: Aristotle: The first formal logician

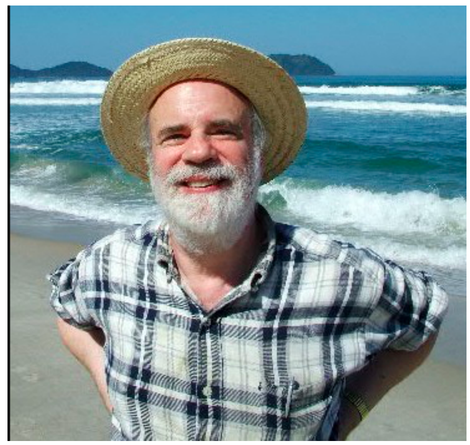

Figure 2: Saul Kripke: we've come a long way since then.

Aristotle image source
Saul Kripke image source
Make sure you follow these links, so you know where the hyperlinks lead to when you typeset it yourself.

Assertion	**Negation**
$p(x)$	$\neg p(x)$
$\bot$	$p(x) \vee \neg p(x)$ $\top$
$p(x) \wedge q(x)$	$\neg\big(p(x) \wedge (q(x)\big)$ $\neg p(x) \vee \neg q(x)$
$\exists x.p(x)$	$\forall x.\neg p(x)$
$p(x) \Rightarrow q(x)$	$\neg\big(\neg p(x) \vee q(x)\big)$ $p(x) \wedge \neg q(x)$
This statement is false.	

Table 1: Some First Order Logic, and an absurdity.

This table uses `multirow` as well as `multicolumn`. Replicate it as well as you can.

3 Maths, Theorems and References

Theorem 1 (Divergence Theorem)**.**

$$\iiint_V (\boldsymbol{\nabla} \cdot \mathbf{F}) dV = \oiint_S (\mathbf{F} \cdot \hat{\mathbf{n}}) dS$$

Remark. You have definitely studied and applied the theorem extensively in MA 105. It also shows up as Gauss' Law in electrodynamics.

Proposition 3.1 (Georg Cantor)**.** *Let $\mathbb{N}$ be the set of natural numbers. Denote its cardinality $|\mathbb{N}|$ by $\aleph_0$. Let $\mathbb{R}$ be the set of real numbers. Its cardinality $\mathfrak{c}$ is sometimes called the cardinality of the continuum.* $\mathfrak{c} = 2^{\aleph_0}$

Hint. You will find the `\mathfrak` command useful to typeset the above.

Lemma 1 (Jordan Normal Form)**.** *For every matrix M in $\mathbb{C}^{\kappa\times\kappa}$ having eigenvalues $\gamma_1, ..., \gamma_k$, with algebraic multiplicities $m_1, ..., m_k$ respectively, there is an invertible matrix P and a matrix D of the form $D = Diag(J_1, ..., J_k)$ with each block J_i being a $m_i \times m_i$ matrix of the form*

$$J_i = \begin{bmatrix} \gamma_i & 1 & 0 & \dots & 0 \\ 0 & \gamma_i & 1 & \dots & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & \dots & 1 \\ 0 & 0 & 0 & \dots & \gamma_i \end{bmatrix}$$

and $M = P^{-1}DP$. Moreover, if M is an algebraic matrix, so are D and P, and their entries can be computed from the entries of M.

You have certainly studied that if M is defect free, that is, algebraic and multiplicities of its eigenvalues coincide, then it is similar to a diagonal matrix. If not, the Jordan Normal form is the next best thing. We cite [1] for this lemma.

Hint. Look at the bibliography entry for this citation. It is a book. Specify the author, publisher, title, year and edition. Our bibliography style is `plainurl`.

Consider the last statement of Lemma 1. (Yes, a cross reference.) Algebraic numbers are roots of polynomials with integer coefficients. They can be found efficiently. [2].

Hint. This citation is an article. Specify the author, year, title, journal, volume and number.

References

[1] K. Hoffman and R. Kunze. *Linear Algebra*. Prentice-Hall, 2nd edition, 1971.

[2] V. Pan. Optimal and nearly optimal algorithms for approximating polynomial zeros. *Computers & Mathematics with Applications*, 31(12), 1996.

4 Submission Instructions

You needn't copy this page. Please submit a zip file that contains all the files you need (tex, bib, images) to make the pdf.

Please name the zip file `<RollNumber>_3.zip` eg. `180070035_3.zip`

Remember the scheme! Consider the last digit of your IIT-B roll number. If it is even, submit this assignment to `rwitaban.grades.latex@gmail.com`; if it is odd, submit to `mihir.grades.latex@gmail.com`. Eg. Roll number 180070035 will submit this assignment to Mihir.

The subject of your email should be:
`LS LaTeX: <RollNumber>_3`;
eg: `LS LaTeX: 180070035_3`
Please write your full name in the body of the email.

Please try your best to organise your source code for readability.