RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES,

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

LATEX Assignment -1

Contents

This is an assignment. We are not sharing the source code for this document- you'll have to look up the titles of each section (Overleaf is a great source), and try to replicate the features we demonstrate the best you can.

Don't forget to give yours ID when you submit the .file !

We recommend you attempt this assignment in the online Overleaf editor for the most convenient workflow. The MacTeX distribution has all packages installed.

Some of the packages might give you troubles in your offline LATEX distribution, if so, you can switch over to Overleaf.

Your submission should contain a zip containing
1. Your source code (.tex file, .bib file) and supporting images, if any. The .tex file must be named " .tex"
2. The pdf file, whose name must be " .pdf"
3. The zip should be named " .zip" Consider of your IIIT-B roll number and the assignment number.
4. Same code should be in your Git Hub Account
5. B19XXXX.zip file need to be upload into (Server/Git-Hub rguktb-cse/your course Will be specify in your lab)

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1   Knitting Patterns

This class provides a very convenient way to introduce boxed diagrams. We are thus going to use our stock image a few more times. Also, it has a few features to make knitting instructions more readable, however, we can adapt them to make prettier documents for our purposes as well.
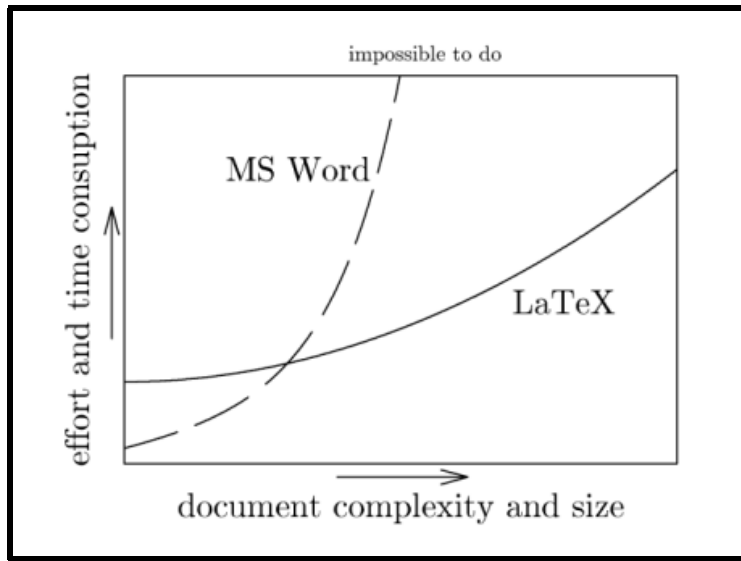

We have a way of highlighting important text, or as was originally intended, important instructions. Feel free to choose whatever background and border colour you like when you replicate these features, but try to replicate the dimensions as well as you can.

| Course	Credits
Introduction to Computer Programming	6
Abstractions and Paradigms in Programming	6
Abstractions and Paradigms in Programming Lab	3
Data Structure and Algorithms	6
Software Systems Lab	8

Note
This is a note. The above feature was introduced to typeset a sequence of knitting instructions. The first column is for the instruction, the second for the number of stitches. But hey, it looks cool!
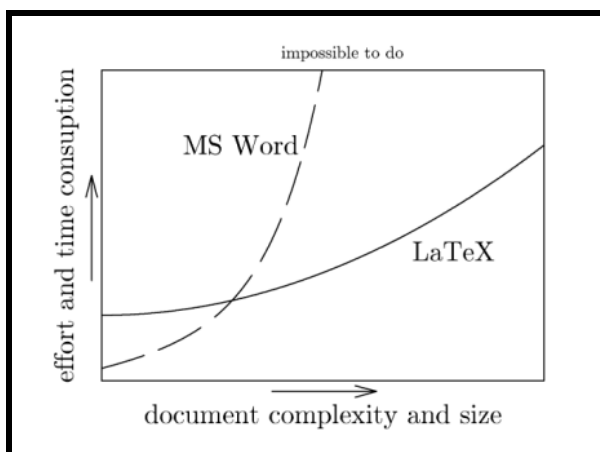

Look at the adjoining graph. Yes, you've seen it before. This time, it is side by side with a paragraph! And there's a beautiful box around it! By default, this will be a quarter of the width of the page. If you follow the hint that is the title of this section, you won't have to type in cumbersome code to fit in images. Also, have you noticed that the pages are much wider? A lot of it will be clear when you read up on the knittingpatterns class. It is already available with the MacTeX distributions, and of course, online on Overleaf. If your distribution does not offer it, download it from here and copy the .cls file to the folder/directory your code is in. See the point where stuff becomes exponentially harder to do without LaTeX? We daresay the rest of this assignment crosses that point. Good luck!

2 Chess Notation

**Adolf Anderssen - Lionel Kieseritzky**
London, 1851
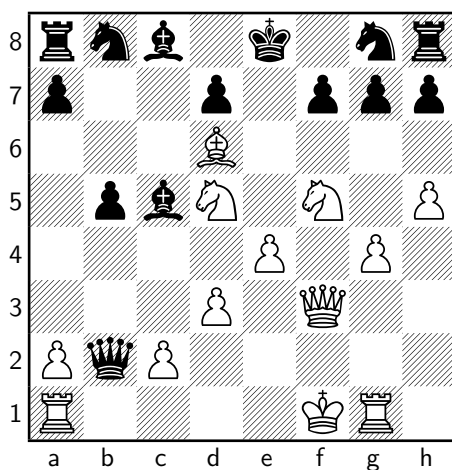
In this position, Black played **18...♗×g1**, taking the rook. Had he opted for 18...♛×a1, he would be better, but still in trouble. However, his choice allowed for a spectacular finish. **19 e5!** Blunting the Queen's protection of g7. **19...♛×a1+**. What else? The rook is en-prise. **20 ♔e2 ♞a6**. This covers the c7 square, as White was threatening Mate in 2, example like 20...h6 21 ♘×g7+ ♔d8 22 ♗c7♯ . **21 ♘×g7+ ♔d8 22 ♛f6+!**
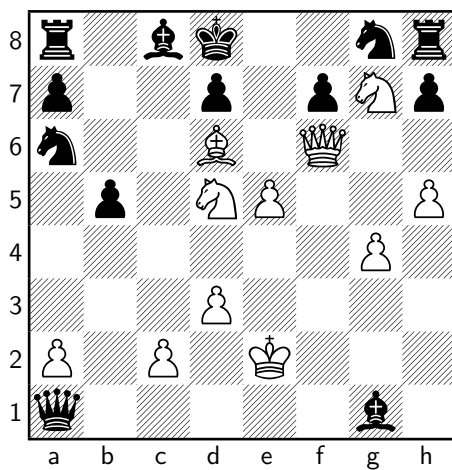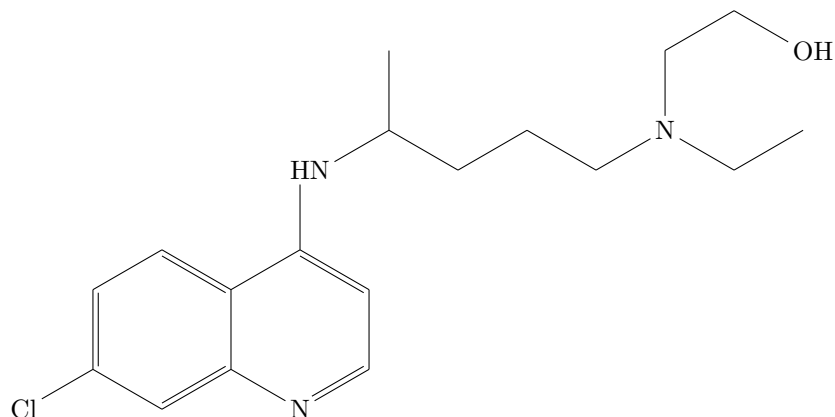
A brilliant Queen sacrifice to deflect the Knight on g8 that protects e7 **22...♘×f6 23 ♗e7♯**
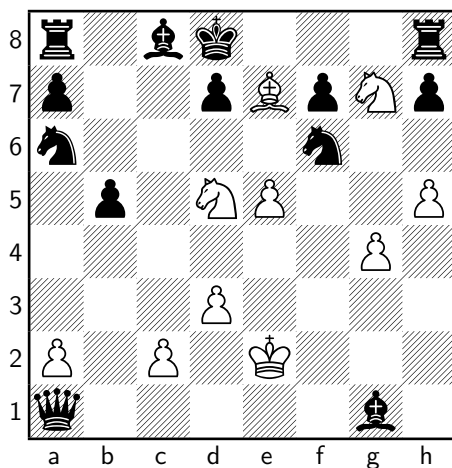
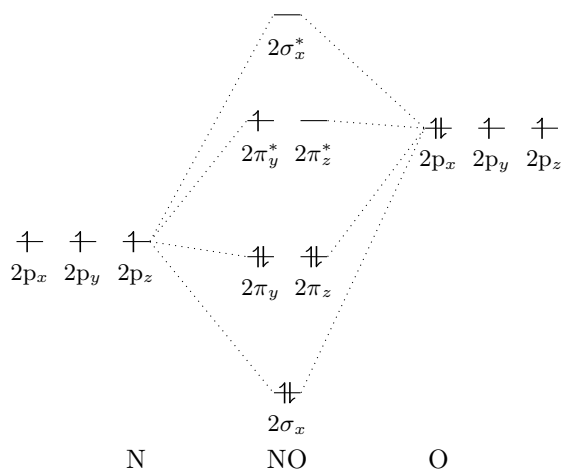Chess enthusiasts will have immediately recognised this as The Immortal Game. Try typesetting this!

3 Chemistry

3.1 Chemical Formulae

This is the molecule hydroxychloroquine, that recently shot to fame as a proposed cure for COVID-19. Please draw it. This is a helpful Overleaf tutorial to help you get started.
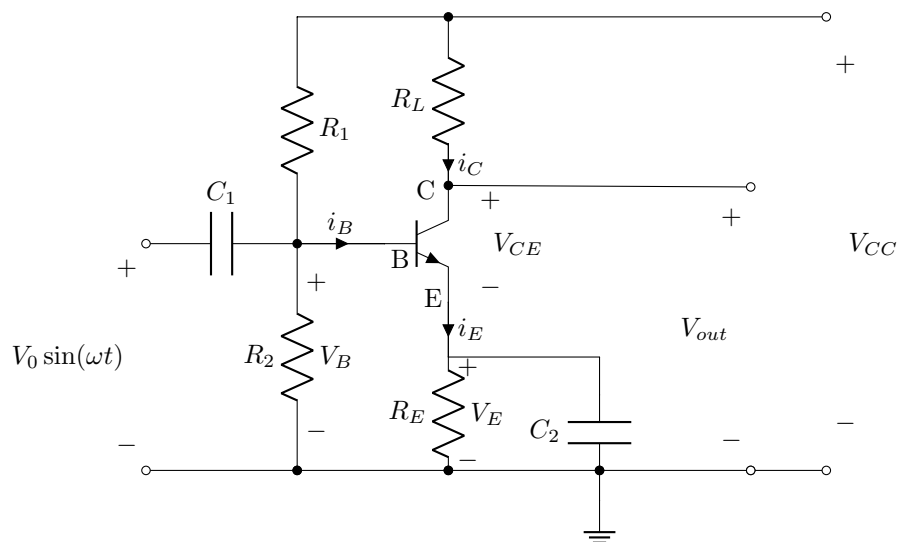
3.2 Molecular Orbital Diagrams

You've probably mugged this up for JEE, and definitely learnt more about this in CH 107.

Draw the above molecular orbital diagram for nitric oxide. Again, exact dimensions needn't match.

4   Electrical Circuits

If you recall JEE Physics, this is a circuit diagram of an npn transistor used as an amplifier. Try your best to match this circuit. We have used the American voltages convention. It is alright if you can't get the dimensions to match. What is important is that you know how to use circuitikz to draw circuits with the components used above, and mark voltages and currents.

5   Typesetting exams

Congratulations, you're appointed as a TA for that course you loved last year. The prof, however, is busy with his research, and wants you to typeset an exam. LaTeX, with its `exam` class can help you do just that!

You'll need to make a separate document, if you want to attempt this task. Your job is to imitate the `exam.pdf` that we have provided.

Problem 1. Show that there exists no nontrivial unramified extensions of $\mathbb{Q}$.

Solution: If $K/\mathbb{Q}$ is a nontrivial number field, then $|\operatorname{disc} K| > 1$. But then $\operatorname{disc} K$ has a prime factor so that some prime ramifies in K. □

Problem 2. Complete the following:

(a) How does one prove a cotheorem?

(b) Compute $\int \cos x \, dx$.

(c) How does one square $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$?

Solution:

(a) Use rollaries.

(b) We have
$$\int \cos x \, dx = \sin x + C \tag{1}$$
We can check (1):
$$\frac{d}{dx}(\sin x + C) = \cos x$$

(c) This is routine.

□

Problem 3. Prove that $\sqrt{2}$ is irrational.

Proof. Assume that $\sqrt{2} = \frac{a}{b}$, where $a, b \in \mathbb{Z}$. Without loss of generality, we may assume $\gcd(a,b) = 1$. Then we have
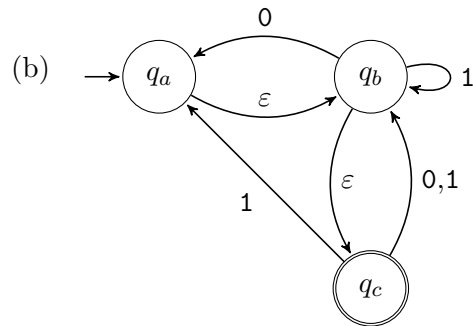$$\sqrt{2} = \frac{a}{b}$$
$$\sqrt{2}^2 = \left(\frac{a}{b}\right)^2 \tag{2}$$
$$2 = \frac{a^2}{b^2}$$
$$a^2 = 2b^2 \tag{3}$$

But then from (3), we know that a^2 is even so that a is even. But then we must have
$$2a^2 = b^2$$
so that b^2 is even, implying b is even. But then $\gcd(a,b) \geq 2$, a contradiction. □

(b)

4. **Solving puzzle #1** In class, we did three puzzles, the first of which is equivalent to finite automata. In general, a puzzle of this type has a frame like this (but possibly with more/fewer squares and different colors):
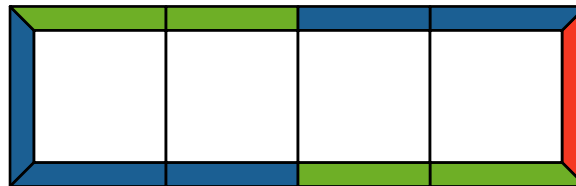
And a finite set of tiles like this (but possibly with more/fewer tiles and different colors):

The tiles must be arranged so that adjacent areas have matching colors. There is an unlimited number of copies of each tile.

(a) Show how every puzzle of this type can be converted into a finite automaton M and a string w such that M accepts w if and only if the puzzle has a solution.

(b) Apply your construction to the above instance.

(c) Briefly describe how this gives an $O(n)$ algorithm for solving puzzles of this type.