

# ICS 353 - Homework 1

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Attempted: 6 of 7

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## 1 Textbook §1 Exer 4

The paragraph here should give the solution of Exercise 4 of Chapter/Section 1 of the textbook (by default). When you are done, copy the header of the question, and change the details for the next exercise. Keep the header even if you dont solve the problem to maintain the correct numbering of the questions, like Question 2 below.

## 2 Textbook §1 Exer 5

## 3 Textbook §2 Exer 1

Assume this exercise has several parts, and parts (a,b, d) are required.

(a) This paragraph gives the solution of Exercise 1 part (a) of Chapter/Section 2 of the textbook. If an exercise has several parts, it will only have one header and a tag for each part like this. If this HW asks for 3 parts (a, b and d), and you dont solve part (b) for example, then leave an empty tag for part (b), like this:

(b) ...

(d) If part (b) was not included in the HW. You should not leave the empty tag. Just write the tags for (a) and (d). Parts with wrong tags may not be graded correctly. If you attempt any part, you should list all other required parts, and count this exercise as *Attempted* in  $X$  of  $Y$  in the *main header*. If you did not attempt any part at all, just keep an empty exercise header like in Question 2.

## 4 BubbleSort §1.2 Exer 2

This is an example of a question taken from a handout or a book other than the default textbook.

## 5 Extra problem: EP 1

Sometimes extra problems are given by the instructor without a book reference. This shows the header format of extra problems. Notice that the section number is also skipped.

## 6 Extra problem: EP 2

Equations and graphs can be properly edited using professional tools, like this:

$$y = \sum_{i=1}^n x_i^3 \sqrt{x_{i+1}}$$

You may use any software of your choice to write your homework, L<sup>A</sup>T<sub>E</sub>X is highly recommended. Notice that in L<sup>A</sup>T<sub>E</sub>X we use double dollar-sign \$\$ to put the equation in a Display form. However, we can use single dollar-sign to have the same equation in-line. For example, we may have  $y = \sum_{i=1}^n x_i^2 \sqrt{x_{i+1}}$  which looks very neat in text (in-line) form. L<sup>A</sup>T<sub>E</sub>X makes it easy to use other Latin symbols instead of  $x$  and  $y$ , like this

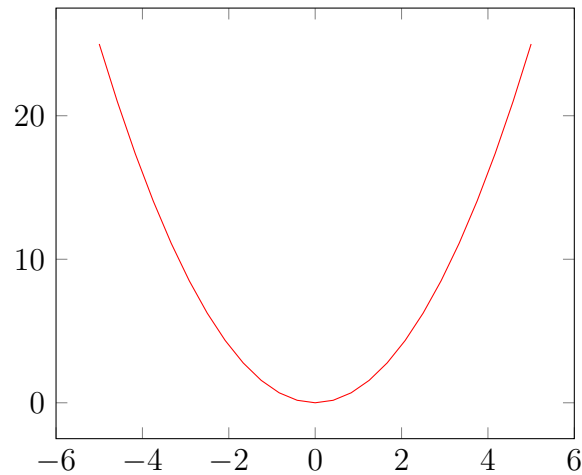
$$\beta = \sum_{i=1}^{\gamma^n} \alpha_i^2 \sqrt{\delta_{i+1}}$$

For logical equations, use `\longrightarrow` for *if*. It looks prettier than `\to`. Also, use `\longleftarrow` for *if-and-only-if*. See for example the following equation in Display form:

$$\forall x \exists y P(x) \wedge \neg Q(y) \longrightarrow R(x, y)$$

(a) How to plot graphs in  $X - Y$  plane?

For graphs, use package **tikz** and **pgfplots**. For example, suppose we want to plot  $y = x^2$ . We just use the **addplot** command defined in package **pgfplots** and get this graph.

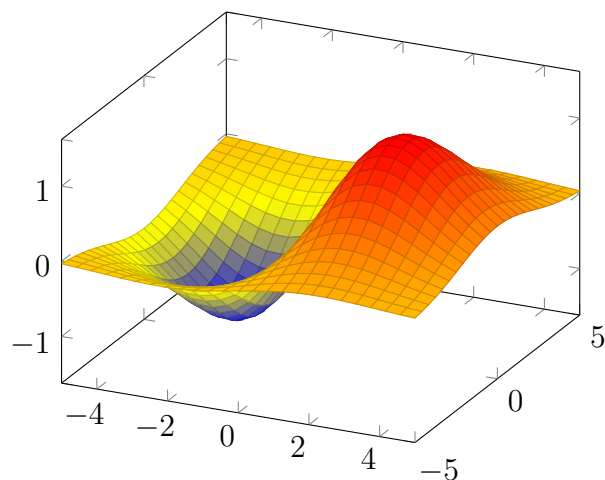


(b) How to plot 3D graphs?

For 3D plots, suppose we want to plot this equation:

$$z = e^{-(x^2/10) - (y^2/10)} x$$

We can use the **addplot3** command and get this beautiful 3D graph.



(c) How to draw network graphs?

Network graphs has nodes (vertices) and edges (links). The edges can be either directed

or undirected. To draw network graphs use package **tikz**. Please see the example in Figure 1.

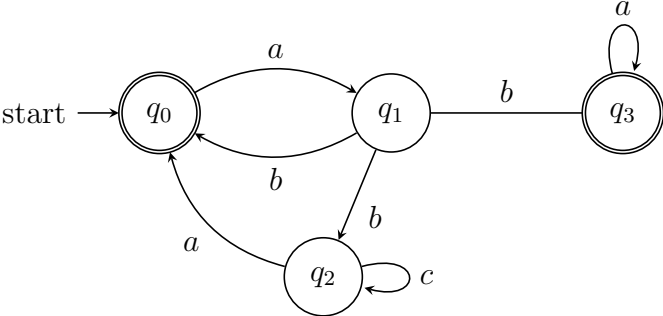
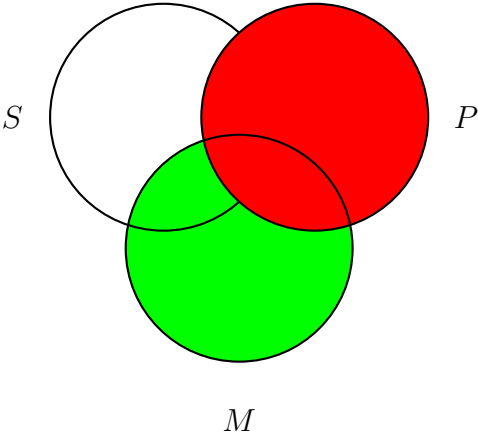


Figure 1: Example of a graph using tikz

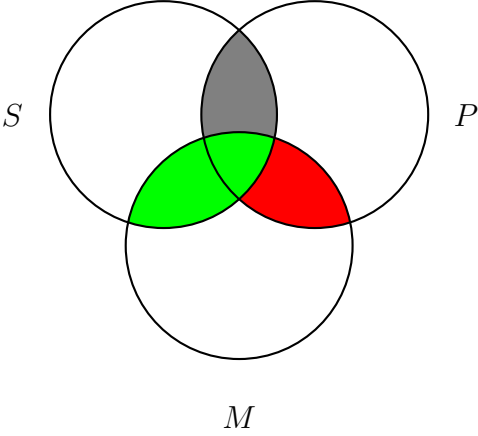
(d) How to draw Venn diagrams?

In *tikzpicture*, use the *draw* and *fill* commands to draw the circles, and fill them with colors. The order of these command is important. See this example.

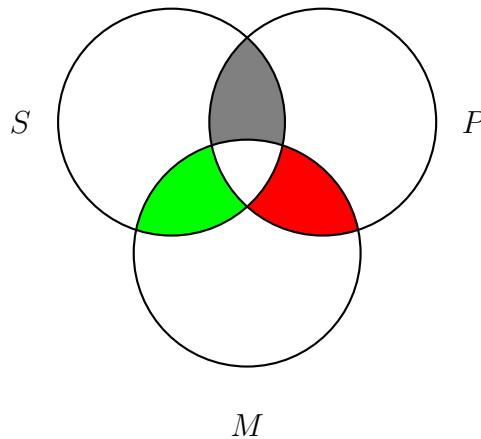


(e) How to highlight the intersection in Venn diagrams?

Use the *clip* and *fill* commands. See this example.



(f) In Venn diagrams, can I use the white color to remove the shade of some parts?  
 Yes. See this example.



## 7 Extra problem: EP 3

(a) How to make tables?

For tables, use the **tabular** command. Here is an example of a table with 4 columns.

| Day | Min  | Avg | Max  |
|-----|------|-----|------|
| Sun | 1.00 | 1.5 | 2.00 |
| Mon | 2.50 | 3.0 | 3.75 |
| Tue | 10   | 25  | 35   |
| Wed | 1    | 1   | 1    |

(b) How to make lists?

In the above example, we can notice the followings:

1. The first line begins (or starts) the tabular with 4 columns, tagged with  $\{|c|l|c|r|\}$ . These tags to justify the text in each column. The first  $c$  means that the first column is centered.  $l$  means left-justified, and  $r$  means right-justified.
2. All the tags are separated by  $|$ , which means draw a vertical lines between the columns. Try to remove one vertical line and see the output.
3. Use  $\&$  to separate between columns entries in one row.
4. To move to the next row use  $\backslash\backslash$  for new line.
5. To draw a horizontal line under that row use the  $\hline$  command.
6. The  $\end$  command is to end the tabular.
7. That was how to make a table in Latex.

8. It also shows how to write a list of items in Latex ☺
9. If you want it with bullets instead of numbers, just use **itemize** instead of **enumerate** in the begin and end commands of this list.

## 8 Textbook §2.2 Exer 5

Here we will answer some questions about writing algorithms.

(a) How to write an algorithm?

You can use the *algorithm* package. Then write the algorithm as follows:

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### Algorithm 1 Find-Length

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**Input:** Initial State  $S$ , Function  $f$

**Output :** Length of the cycle in  $f$

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1:  $T \leftarrow S$ 
2:  $counter \leftarrow 1$ 
3: while  $True$  do
4:    $T \leftarrow T[1, \dots, n - 1] + f(T)$ 
5:   if  $S = T$  then
6:      $break$ 
7:   end if
8:    $counter = counter + 1$ 
9: end while
10: return  $counter$ 

```

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(b) How to write complexity notations?

You can use any of the following notations:  $O$ ,  $\Omega$  and  $\Theta$ , either in upper case or lower case. Many functions are already defined in latex. For example,  $O(n^2)$ ,  $\Omega(n \log n)$ , and  $\Theta(\sqrt{n})$ . If the function is not defined, you can use the `\mathrm` command to write it. For example,  $\Omega(n \ a \ n)$ . Notice the use of  $\sim$  to force extra space.