

University of Waterloo  
CS240, CS240E Winter 2023  
Tutorial 00 Solutions

## 1 Mathematics

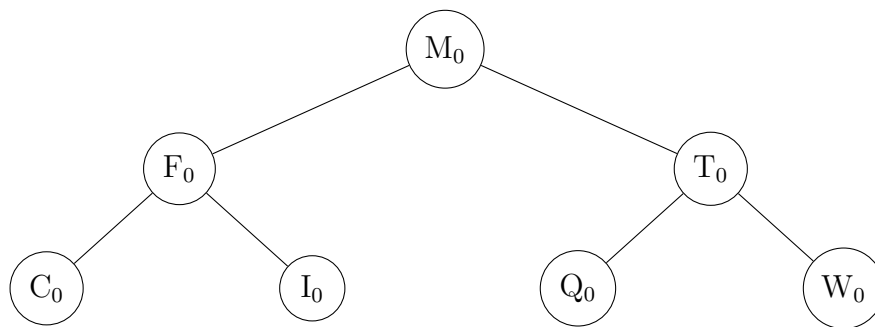
Write a proof showing that  $\log(n!) \in O(n \log n)$ .

$$\begin{aligned}\log(n!) &= \log\left(\prod_{i=1}^n i\right) \\ &= \sum_{i=1}^n \log(i) \\ &\leq \sum_{i=1}^n \log(n) \\ &= n \log n\end{aligned}$$

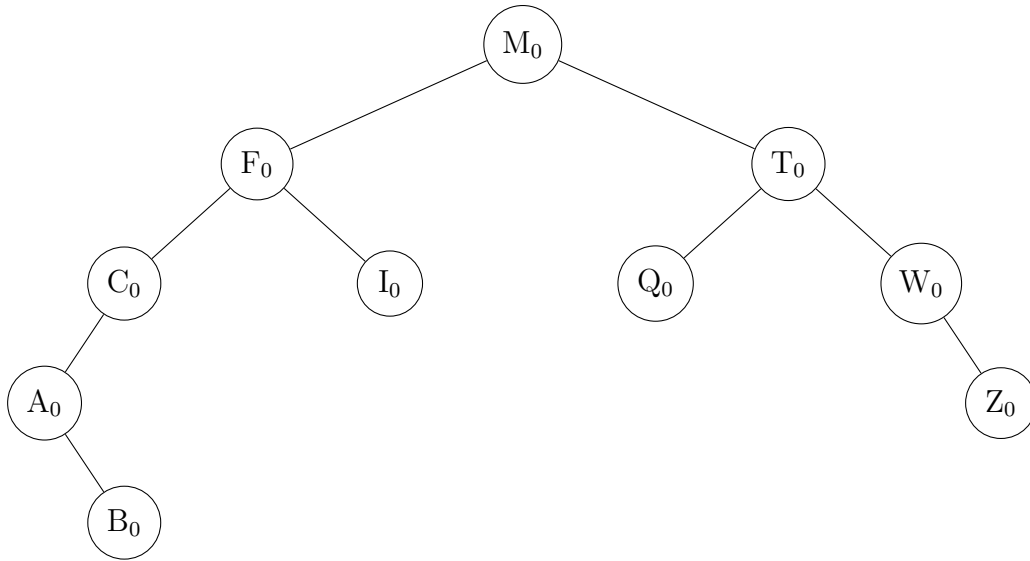
Choosing  $c = 1$  and  $n_0 = 1$ , we have  $\log(n!) \in O(n \log n)$ .

## 2 Trees

We will add the letters Z, A, and B to the BST below.



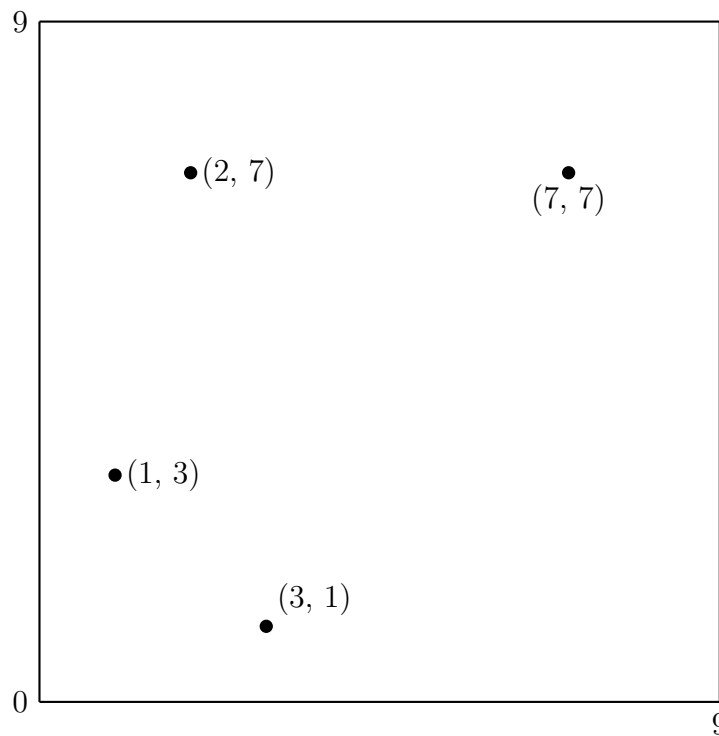
*Hint: For nodes with only one child, you may wish to use “child[missing]” for the non-existent child.*



### 3 Plots

Plot the following points below. Only show the resulting plot.

Points:  $(2,7)$ ,  $(1,3)$ ,  $(3,1)$ ,  $(7,7)$



## 4 Latex Resources

### L<sup>A</sup>T<sub>E</sub>X Editors

- a) TeX Live: <https://www.tug.org/texlive/>
- b) TeXstudio: <https://www.texstudio.org/>
- c) Overleaf: <https://www.overleaf.com/>
- d) pdflatex: on the student environment

### Miscellaneous Resources

- <http://detexify.kirelabs.org/classify.html>
- [https://oeis.org/wiki/List\\_of\\_LaTeX\\_mathematical\\_symbols](https://oeis.org/wiki/List_of_LaTeX_mathematical_symbols)
- <https://en.wikibooks.org/wiki/LaTeX>
- <https://tex.stackexchange.com/>