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CS4102
Homework 1 - LaTex Tutorial

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Problem 1 [5]

$$\begin{aligned}
\frac{n!}{r!(n-r)!} &= \frac{(n-1)!}{r!(n-1-r)!} + \frac{(n-1)!}{(r-1)!((n-1)-(r-1))!} \\
&= \frac{(n-1)!}{r!(n-1-r)!} + \frac{(n-1)!}{(r-1)!(n-r)!} \\
&= \dots \\
&= \frac{(n-r+r)(n-1)!}{r(r-1)!(n-1)(n-r-1)!} \\
&= \frac{(n)(n-1)!}{r(r-1)!(n-r)(n-r-1)!} \\
&= \frac{n!}{r!(n-r)!}
\end{aligned} \tag{1}$$

Problem 2 [5]

$$\begin{gathered}\varphi = \exists_x : \forall_y : y \in x \\ \forall_x (x \neq \emptyset \rightarrow \exists_y \in x (y \cap x = \emptyset)) \\ \exists_x (x \neq \emptyset \rightarrow \forall_y \in x (y \cap x \neq \emptyset)) \\ \exists_y \in x (y \cap x \neq \emptyset) \\ \{y \cap x = \emptyset, y \cap x \neq \emptyset\} \vdash \phi\end{gathered} \tag{2}$$

Problem 3 [5]

$$T(n) = \left[T\frac{n}{2^i} + \sum_{k=0}^{i-1} \left(\log_2 \frac{n}{2^k} \right) \right] + 1 \tag{3}$$