Homework Assignment #5
Due: October 24, 2025 at 11:59 p.m.

1. Theorem 26.1 on page 121 of the course kit shows that every greedy scheduler executes a computation in time $T_P \leq T_1/P + T_\infty$. The proof defines complete and incomplete steps.

[2] **(a)** If a schedule has i incomplete steps, show that the total amount of work done in all the complete steps is at most $T_1 - i$.

[3] **(b)** If a schedule has i incomplete steps, show that the total number of steps is at most $\frac{T_1}{P} + (1 - \frac{1}{P})i$.

[3] **(c)** Strengthen Theorem 26.1 to show that every greedy scheduler achieves $T_P \leq \frac{T_1 - T_\infty}{P} + T_\infty$.

[2] **(d)** Show that the bound in part (c) is tight for all serial algorithms (without any forks).

[4] **(e)** Show that there are arbitrarily large task-parallel computation graphs for which some greedy schedule takes exactly $\frac{T_1 - T_\infty}{P} + T_\infty$ steps to execute the computation on P processors, even when the graph is highly parallelizable (meaning many steps are scheduled to be complete).