

# System-on-Chip (SoC) Design

ECE382M.20, Fall 2026

## Homework #2

Assigned: September 24, 2026

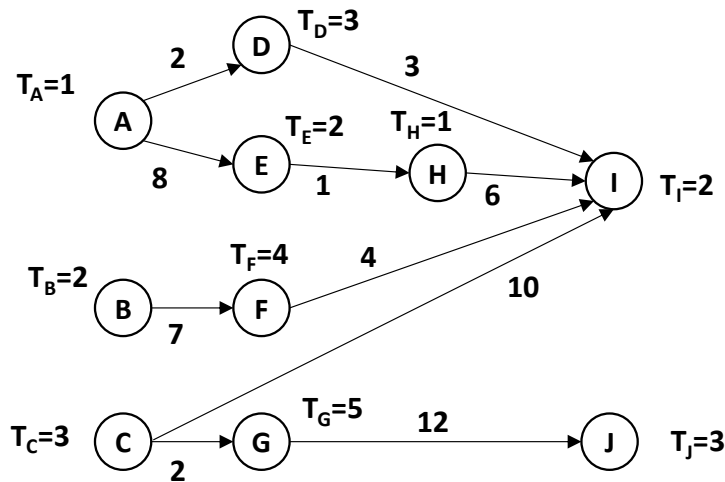
Due: October 8, 2026

### Instructions:

- Please submit your solutions via Canvas. Submissions should include a single PDF with the writeup and single Zip or Tar archive for source code.
- You may discuss the problems with your classmates but make sure to submit your own independent and individual solutions.

### Problem 1: Task Partitioning (50 points)

Consider the following task graph with given computation times and communication costs:



- Apply a hierarchical clustering algorithm to partition the graph onto three processors such that communication is minimized assuming a shared system bus where the cost of clustered nodes is the sum of communication delays with other nodes. Show the graphs and costs after each clustering step and the final partition.
- How would you extend the Kernighan-Lin (KL) algorithm to support minimization of the sum of communication costs in a 3-processor system? Briefly describe your KL extensions, and assuming you start from the 3-processor solution in (a), show at least the first step(s) (one swap) of your extended algorithm (you do not need to show a complete iteration of the algorithm).

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**Problem 2: Task Scheduling (50 points)**

- (a) Given the task graph with annotated execution times from Problem 1. Assuming all communication costs are zero, describe an algorithm to schedule and map the graph onto three homogeneous processors such that the schedule makespan/length is minimized. Demonstrate your algorithm on the task graph from Problem 1. Is your algorithm optimal? If yes, why? If not generally, is your algorithm optimal for certain task graph instances, and if so which ones?
- (b) Now assuming non-zero communication times, e.g. as given in Problem 2, could you extend your algorithm to account for communication overhead and, if so, how?