

CECS 329, Quiz 1, Spring 2026, Dr. Ebert

IMPORTANT: READ THE FOLLOWING DIRECTIONS.

- For each problem, write your solution using **ONE SHEET OF PAPER ONLY (BOTH FRONT AND BACK)**. Write **NAME** and **PROBLEM NUMBER** on each sheet.
- Write solutions to different problems on **SEPARATE SHEETS** of paper.

Unit 1 LO Problems

LO1. Solve the following.

- (a) Is it true that $\{\{1\}, \{3, 4\}, \{1, 3, 5\}\} \in \mathcal{P}(\{1, 2, 3, 4, 5\})$? **Explain.** Also, if function

$$f : \mathcal{N} \rightarrow \mathcal{P}(\mathcal{N})$$

is defined by $f(n)$ equals the set of all natural numbers that divide evenly into n , then compute $f(17)$ and $f(68)$. Hint: non-primes should also be included.

- (b) Consider the 2SAT instance

$$\mathcal{C} = \{(x_1, x_2), (x_1, x_6), (\bar{x}_1, \bar{x}_2), (x_3, \bar{x}_6), (\bar{x}_3, x_4), (\bar{x}_4, \bar{x}_5)(x_4, x_6), (x_5, x_6), \}.$$

- Draw the implication graph $G_{\mathcal{C}}$.
- Perform the **Improved 2SAT** algorithm by computing the necessary reachability sets. Use numerical order (in terms of the variable index) and positive literal before negative literal when choosing the reachability set to compute next. Draw the resulting reduced 2SAT instance whenever a consistent reachability set is computed. Either provide a final satisfying assignment for \mathcal{C} or indicate why \mathcal{C} is unsatisfiable.

LO2. Answer the following.

- Provide the definition of what it means to be a mapping reduction from problem A to problem B .
- Recall the mapping reduction $f : \text{SP} \rightarrow \text{SS}$ from **Set Partition** to **Subset Sum** provided in lecture. Compute $f(S)$ for

$$S = \{1, 3, 6, 10, 16\}.$$

- Verify that f is a valid mapping reduction for input S in the sense that S and $f(S)$ are either both positive instances or both negative instances of their respective decision problems. **Defend your answer.**