CS/ECE 374 A (Spring 2024)
DRES Final Exam

Name:	
NetID:	

- Date/Time: May 10 Friday.
- You may bring **two double-sided 8.5" × 11" cheat sheets**, with your name and NetID written on the upper right corner. (Four single-sided sheets are okay.) The sheets should be **handwritten** by you (not photocopied or printed).
- Except for your writing implements, your cheat sheets, and your university ID card, please put everything away for the duration of the exam. In particular, please turn off and put away *all electronic devices* other than those that are medically necessary.
- This exam booklet is **double-sided**! The total number of points is 100.
- **At the top of *every* page, please write your name.** We will scan every page in your exam booklet into Gradescope. (If you have been using an alias/non-university email address on Gradescope and have already submitted the form on Gradescope identity, you may alternatively use your alias/non-university email address in place of your real name/netid.)
- Please **don't write in the gray area, i.e., stay inside the white box in each page**; the scanner may not see what is written outside this box (being too close to the edge of the page).
- The scanner sometimes may still see things that you erase with a pencil eraser; we suggest you **cross out parts that you intend to erase**, to make it clear which parts we should grade.
- All answers should be placed in the spaces given. If you need more space to complete an answer, you may use the blank pages at the end, but please clearly indicate where we should look.
- You may use the blank pages at the end for scratch work.
- Submit your cheat sheets (and all scratch papers) along with your exam booklet when you are finished.
  - If you are NOT using a cheat sheet, please check this box. ☐
- You are reminded to follow the course's and university's academic integrity policies (the penalty for cheating is severe).

Note for DRES Exams: We may not always be able to answer your queries on time during your exam. If you believe the statement of an exam problem is incomplete or has errors, please state your assumptions clearly and solve the problem accordingly. If we find that your assumptions and interpretation of the problem are reasonable under the circumstances and you solve the problem correctly under your assumptions, you may receive partial or (often times) full credit for the problem.

don't write in gray area

List of Known Standard NP-Complete Problems

- 3SAT:

  Input: Boolean formula F in 3CNF form.

  Output: yes iff there exists an assignment that makes F evaluate to true.

- Vertex-Cover:

  Input: undirected graph $G = (V, E)$ and a number K.

  Output: yes iff there exists a vertex cover S of size (at most) K. (A vertex cover is a subset $S \subseteq V$ such that for every $uv \in E$, we have $u \in S$ or $v \in S$.)

- Independent-Set:

  Input: undirected graph $G = (V, E)$ and a number K.

  Output: yes iff there exists an independent set S of size (at least) K. (An independent set is a subset $S \subseteq V$ such that for every $u \in S$ and $v \in S$, we have $uv \notin E$.)

- Clique:

  Input: undirected graph $G = (V, E)$ and a number K.

  Output: yes iff there exists a clique S of size (at least) K. (A clique is a subset $S \subseteq V$ such that for every $u \in S$ and $v \in S$, we have $uv \in E$.)

- Hamiltonian-Cycle/Hamiltonian-Path:

  Input: undirected graph $G = (V, E)$.

  Output: yes iff there exists a Hamilonian cycle/path, i.e., a cycle/path that visits every vertex in V exactly once.

- 3-Coloring:

  Input: undirected graph $G = (V, E)$.

  Output: yes iff there exists a 3-coloring, i.e., a mapping $\varphi : V \to \{1, 2, 3\}$ such that for every $uv \in E$, we have $\varphi(u) \neq \varphi(v)$.

- Subset-Sum:

  Input: a set S of integers and a number W.

  Output: yes iff there exists a subset of S whose sum is exactly W.

- Set-Cover:

  Input: a set U of elements, a collection $\mathcal{C}$ of subsets of U, and a number K.

  Output: yes iff there exists a subcollection $\mathcal{S} \subseteq \mathcal{C}$ of (at most) K subsets such that the union of $\mathcal{S}$ is all of U.