Name: _____

1. (1 pt.)

   - **Read all material carefully.**
   - You may refer to your books, papers, and notes during this test.
   - No computer or network access of any kind is allowed (or needed).
   - Write, and draw, carefully. Ambiguous or cryptic answers receive zero credit.
   - Use the conventions used in class and the textbook for all material.
   - COS 480 students should answer non-⋆ questions; ⋆ questions are for extra credit.
   - COS 580 students should answer all questions, including ⋆ questions.

   Write your name in the space provided above.

2. (14 pts.) Recall, from class exercises, the database composed of relations `Students(id, name, year)`, `Courses(id, title, ta)`, and `Enrolls(student, course, credits)`, with the semantics described there.

   Provide an extended relational algebra query for the names of students who are enrolled in courses with a title "Capstone" retaining duplicates if there are multiple students with the same name, but avoiding duplicates for the same student (if they are enrolled in multiple "Capstone" courses, for instance). You may use the *linear notation* to present your query.

   Explain why your query is correct.

3. (15 pts.) Using the schema of Question 2, provide an extended relational algebra query for the set of all tuples (t, s, c) such that $c > 0$ is the total number of credits for which the student with ID s is enrolled and t is the ID of a person who is a TA for **some** class in which s is enrolled. If no such TA exists for a student, then t should be 0 in the tuple for that student. You may use the *linear notation* to present your query.

   Briefly explain why your query is correct.

4. (15 pts.) $\star$ Repeat Question 3 modifed to replace "for **some** class in which s is enrolled" with "for **all** classes in which s is enrolled (same TA for all classes)."