# ECS 20: Discrete Mathematics for Computer Science

Winter 2021

Ji Wang

Week 4, January 25

# Logistics

- Midterm 1 regrade request due tomorrow at 6 pm PST
- Midterm 2 on next Monday, Feb 1

# Outline

- Midterm 1 Summary
- Relations in Computer Science
- Functions Review

# Relations in Computer Science

Suppose $A$ is a set of students' names, $B$ is a set of of student IDs, can we define a relation $R$ that specifies all the currently enrolled students at UC Davis?

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Yes, we can. $R = \{(\text{Ji Wang}, 912345678), (\text{Jayneel Vora}, 923456789), \ldots\}$

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Yes, we can. $R = \{(\text{Ji Wang}, 912345678), (\text{Jayneel Vora}, 923456789), \ldots\}$

However, more often, we want more information about a student, for instance, undergrad/graduate, department, etc. **Can we extend relation $R$ to $n$-ary?**

# Relations in Computer Science

**Definition.** Let $A_1, A_2, \cdots, A_n$ be sets. An $n$-ary relation on these sets is a subset of $A_1 \times A_2 \times \cdots \times A_n$.

[1] Wikipedia

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**App:** Relational Databases [1]

1. Present the data to the user as relations;
2. Provide relational operators to manipulate the data in tabular form.

In practice, we organize data into one or more tables (or "relations") of *columns and rows*, with a unique key identifying each row. Rows are also called records or tuples while columns are also called attributes or fields.

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| Name | ID | Email | Section | Major | $\cdots$ | Grade |
|---|---|---|---|---|---|---|
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# Relations in Computer Science

**Example.** Think about class roster. If you're assigned to design the table to maintain class roster, what are necessary fields?

| Name | ID | Kerberos | Section | Major | $\cdots$ | Grade |
|---|---|---|---|---|---|---|
| Rachel | 932221234 | rgreee | A01 | CSE | $\cdots$ | A- |
| Monica | 932221235 | mgeller | A01 | CSE | $\cdots$ | A+ |
| Phoebe | 921119876 | pbuffay | A03 | ECE | $\cdots$ | B+ |
| Joey | 920001234 | jtri | A03 | MAT | $\cdots$ | A- |
| Chandler | 913339876 | cbing | A02 | CS | $\cdots$ | A |
| Ross | 913339877 | rgeller | A02 | BIO | $\cdots$ | A+ |

Manipulate data by **SQL** (Structured Query Language), e.g. Addition, Deletion, Update and Search.

# Relations in Computer Science (More in ECS-165)

| Name | ID | Kerberos | Section | Major | ··· | Grade |
|---|---|---|---|---|---|---|
| Rachel | 932221234 | rgreee | A01 | CSE | ··· | A- |
| Monica | 932221235 | mgeller | A01 | CSE | ··· | A+ |
| Phoebe | 921119876 | pbuffay | A03 | ECE | ··· | B+ |
| Joey | 920001234 | jtri | A03 | MAT | ··· | A- |
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1. Add student Gunther (no longer on the waitlist):
   `INSERT INTO ecs20_roster VALUES ('Gunther', 931234567, 'gcentral', ···);`
2. Delete Rachel's record (she drops):
   `DELETE FROM ecs20_roster WHERE Name='Rachel';`
3. Update Joey's grade to A:
   `UPDATE ecs20_roster SET Grade = 'A' WHERE Name ='Joey';`
4. Search for all the students in Section A03:
   `SELECT * FROM ecs20_roster WHERE Section = 'A03';`