N- any relations:

Relation \( R \subseteq A_1 \times A_2 \times A_3 \times \ldots \times A_n \).

elements of \( R \) \( n \)-tuples \((a_1, a_2, \ldots, a_n)\) \( a_i \in A_i \)

\((a, b)\) \( \) pairs.
\((a, b, c)\) \( \) triples or tuples.
\((a, b, c, d)\) \( \) 4-tuples

\((a_1, \ldots, a_n)\) \( n \)-tuples

\( R \subseteq \mathbb{Z} \times \mathbb{Z} \times \mathbb{Z} \)

\( R = \{ (x, y, z) \mid x + y = z^3 \} \)

\((2, 3, 5) \in R \)
\((2, 4, 5) \notin R. \quad 2 + 4 \neq 5 \)

Related Databases store information as a set of \( n \)-tuples.

Example: A doctor’s office stores records of patient appointments.

Each appointment \( \leftrightarrow \) one 7-tuple.

(Patient ID, Patient Name, Doctor, Time, Duration, No-Show?)

each of these is called an attribute.

each has its own domain.
Query: a request for a particular kind of data.

Key: Set of attributes that uniquely identifies a record (7-tuple).

(Patient name, date) is not a key
Cheng has two appointments on 11/11

(Patient, doctor, date)
(Patient, date, time)
(Doctor, date, time) assuming no double-booking.

For VCI student database Student ID should work.

Two common operations: SELECT
PROJECT

⇒ SELECT [Some set of conditions]

SELECT [ Patient = "Chang" OR Doctor = "Spencer"
        (__, Chang, Spencer, 11/4/13, SAT, 23, N )
        (__, Cheng, Spencer, 11/11/13, SAT, 22, N )
        SELECT [ Date <= 11/7/13 OR Date >= 11/5/13]
Return Row # 2, 4, 6.
PROJECT [subset of attributes]

deletes all other attributes and then eliminates duplicates.

PROJECT [doctor, patient name]

(Chang, Spencer)
(Zinn, Spencer)
(Smith, Spencer)
(Sanders, Morrison)
(Chang, Spencer)
(Sanders, Morrison)
(Chang, Morrison)

*Which doctor had a “no-show” during the month of November?*

SELECT [No-show = “Y” ∧ Date ≤ 11/30/13 ∧ Date ≥ 11/1/13] PROJECT [doctor].

(Chang, Spencer) 11/15/13 Row 2
(Sanders, Morrison) Row 4

Which patients did Morrison see on 11/5/13?

SELECT [doctor = Morrison ∧ date = 11/5/13] PROJECT [Patient Name]
Next example: What is a key for this DB?

(Order #, Item #)

How much money did Customer X spend in December?

\[
\text{Select } \left\{ \text{date} \leq 12/31/13 \land \text{date} \geq 12/1/13 \land \text{customer} = X \right\}
\]

\text{Project } [\text{Total Price}]

How many tables were sold in the last month?