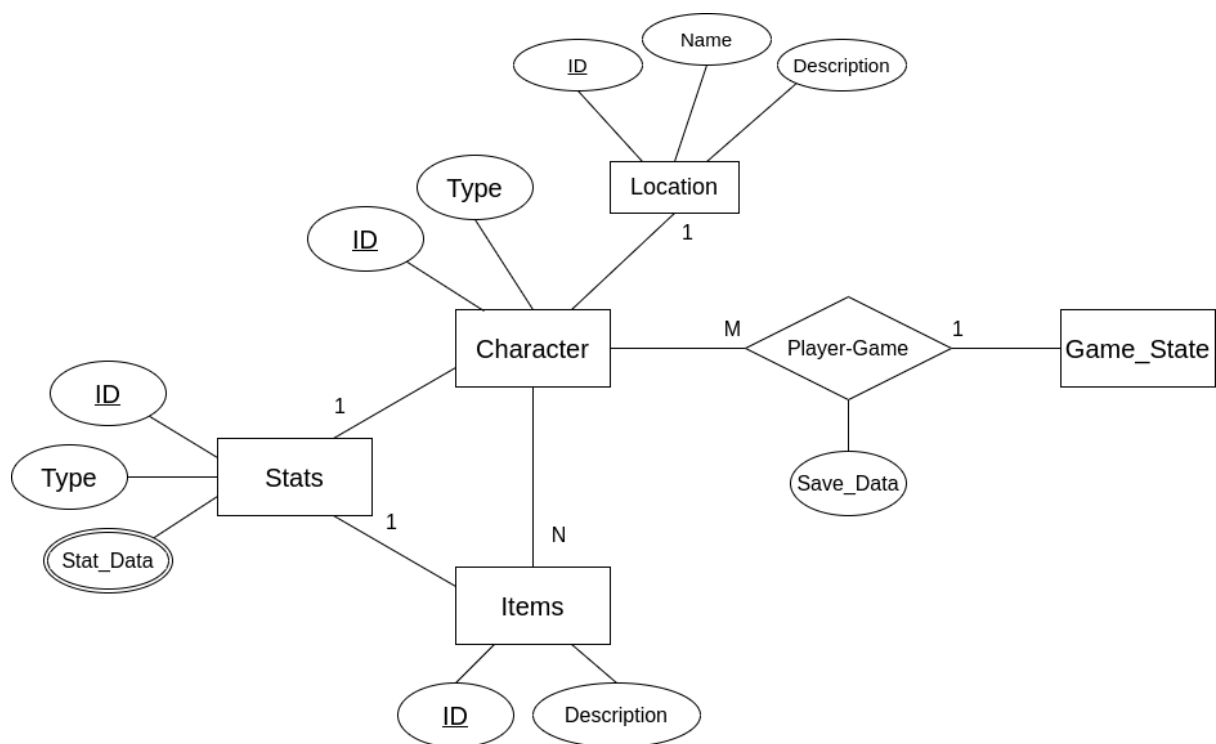


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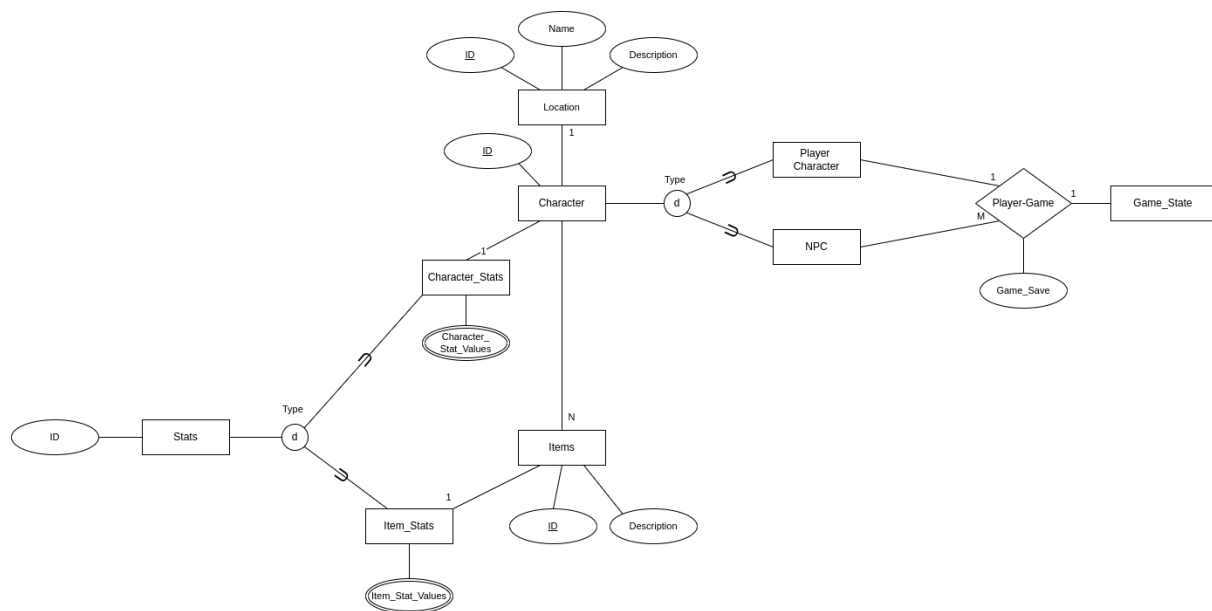
Assignment 3

Question 1

A.



B.



Question 2

Identify functional dependencies

- `student_id` -> `first_name`, `last_name`, `date_of_birth`
- `unit_code` -> `unit_name`
- `degree` -> `school`, `degree_length`

Define Keys

- `student_id`
- `unit_code`
- `degree`
- `student_id`, `unit_code`, `degree` (composite key)

Normalise the schema

Student Table

- student_id (Primary Key)
- first_name
- last_name
- date_of_birth

Unit Table

- unit_code (Primary Key)
- unit_name

Degree Table

- degree (Primary Key)
- school
- degree_length

Enrollment Table

- student_id (Foreign Key)
- unit_code (Foreign Key)
- degree (Foreign Key)

Every table fully depends on its primary key, ensuring compliance with third normal form (3NF). The Enrollment table represents the relationship between students and the units they are enrolled in, as well as the degrees these units count towards. Using a composite key prevents students from enrolling in the same unit for the same degree multiple times, thus reducing redundancy and maintaining 3NF compliance.

Question 3

Database Schema: A, B, C, D, E

Functional Dependancies

1. $D \rightarrow CE$
2. $A \rightarrow B$
3. $B \rightarrow E$
4. $C \rightarrow B$

Decomposition

- R1 = {CAE}
- R2 = {DB}
- R3 = {ABD}

Step 1 + 2:

- Create an initial matrix of size attribute i by relations j
- Place B_{ij} in each empty cell

	A	B	C	D	E
R1	B11	B12	B13	B14	B15
R2	B21	B22	B23	B24	B25
R3	B31	B32	B33	B34	B35

Step 3:

- Place A_i in each cell that corresponds to an attribute in the relation row

	A	B	C	D	E
R1	A1	B12	A3	B14	A5
R2	B21	A2	B23	A4	B25
R3	A1	A2	B33	A4	B35

Step 4:

- For all key attributes per row:
- Find cells in row containing key X with B_{ij}
- Place A_i in each cell associated with Y, if the FD exists in another row
- Repeat for all dependencies

	A	B	C	D	E
R1	A1	A2	A3	B14	A5
R2	B21	A2	A3	A4	A5
R3	A1	A2	A3	A4	A5

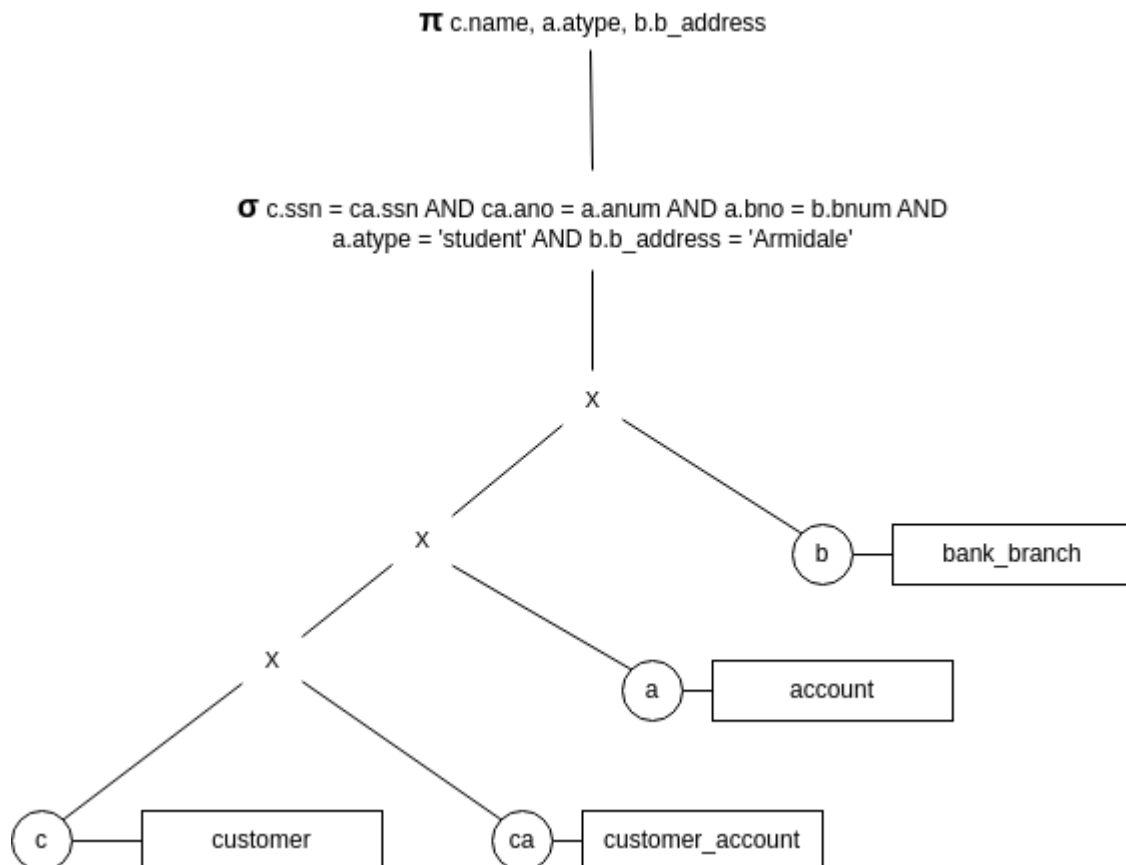
Step 5:

If a row contains all A_i then the decomposition is lossless

This decomposition satisfies the requirements to be lossless as R3 contains all A_i values.

Question 4

A.



B.

