Project phase-3

Team ID: 5

Krishak Aneja	Nidhish Jain	Saiyam Jain	Varun Gupta
2023101106	2023101071	2023101135	2023101108

1. ER to Relational Model Mapping: (Tool used: draw.io)

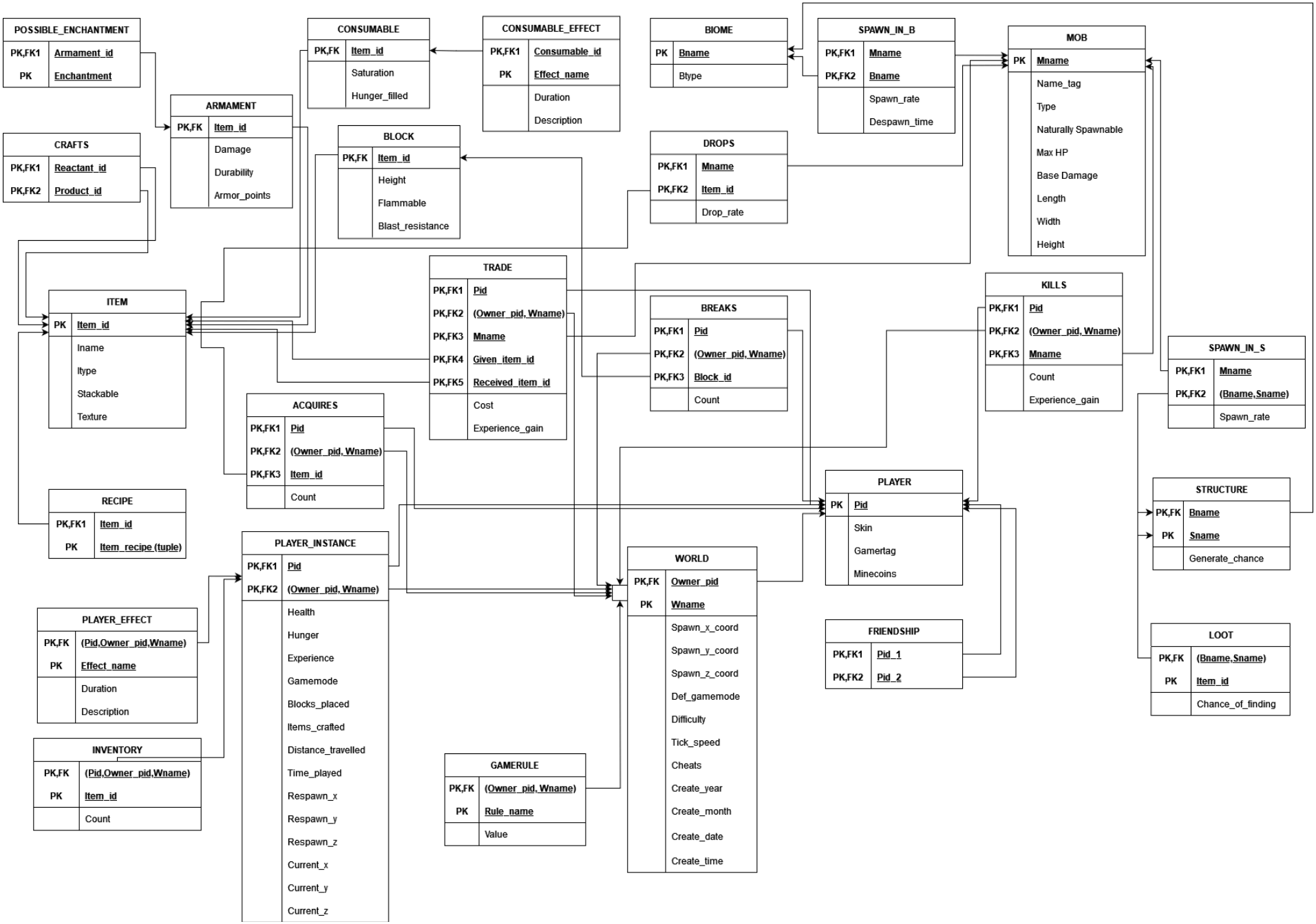
Note: The Description attribute was added to the Effects Composite attribute of Player and Consumable whilst the Effects attribute of Mob was removed. Further, certain Entities, Attributes and Relationships were renamed to reflect the relational model better. Ex: CONTAINS renamed to PLAYER_INSTANCE.

The steps highlighted in sections 9.1-2 of the textbook were employed to convert the ER diagram into a relational model. The following derived attributes have not been represented in the Relational model, since they are not actually stored in the database and are instead computed. Composite attributes have been split into their component attributes.

- **Step 1:** The strong entity types PLAYER, BIOME, MOB and ITEM are mapped to relations with respective primary keys.
- **Step 2:** The weak entity types WORLD and STRUCTURE are mapped to relations with respective partial and foreign keys (the primary keys of owner entity types PLAYER and BIOME).
- **Step 3:** No Binary 1:1 relationship types present.
- **Step 4:** No Binary 1:N relationship types present.
- **Step 5:** Binary M:N relationship types are mapped to cross-referencing relations that include as foreign key attributes the primary keys of the relations representing the participating entity types.
- **Step 6:** Multivalued attributes are mapped as separate relations with foreign keys referencing the primary keys of the entities they are supposed to be of.
- **Step 7:** N-ary (in our case ternary and 5-nary) relationship types are mapped to relations which include as foreign key attributes the primary keys of the relations representing the participating entity types.
- **Step 8:** Subclasses ARMAMENT, BLOCK and CONSUMABLE are mapped to separate relations (option 8A of section 9.2.1) with the primary keys of ITEM (superclass) propagated to them.

2. Conversion to 1NF:

The Relational Model produced by following these steps is already in First Normal Form since Multivalued attributes have been mapped to separate relations already in Step 6 and no nested relations are present in our design.


POSSIBLE_ENCHANTMENT
PK,FK1 Armament_id
PK Enchantment
CONSUMABLE
PK,FK Item_id
Saturation
Hunger_filled
CONSUMABLE_EFFECT
PK,FK1 Consumable_id
PK Effect_name
Duration
Description
BIOME
PK Bname
Btype
SPAWN_IN_B
PK,FK1 Mname
PK,FK2 Bname
Spawn_rate
Despawn_time
MOB
PK Mname
Name_tag
Type
Naturally Spawnable
Max HP
Base Damage
Length
Width
Height
ARMAMENT
PK,FK Item_id
Damage
Durability
Armor_points
CRAFTS
PK,FK1 Reactant_id
PK,FK2 Product_id
BLOCK
PK,FK Item_id
Height
Flammable
Blast_resistance
DROPS
PK,FK1 Mname
PK,FK2 Item_id
Drop_rate
TRADE
PK,FK1 Pid
PK,FK2 (Owner_pid, Wname)
PK,FK3 Mname
PK,FK4 Given_item_id
PK,FK5 Received_item_id
Cost
Experience_gain
ITEM
PK Item_id
Iname
Itype
Stackable
Texture
BREAKS
PK,FK1 Pid
PK,FK2 (Owner_pid, Wname)
PK,FK3 Block_id
Count
KILLS
PK,FK1 Pid
PK,FK2 (Owner_pid, Wname)
PK,FK3 Mname
Count
Experience_gain
SPAWN_IN_S
PK,FK1 Mname
PK,FK2 (Bname,Sname)
Spawn_rate
ACQUIRES
PK,FK1 Pid
PK,FK2 (Owner_pid, Wname)
PK,FK3 Item_id
Count
RECIPE
PK,FK1 Item_id
PK Item_recipe (tuple)
PLAYER
PK Pid
Skin
Gamertag
Minecoins
STRUCTURE
PK,FK Bname
PK Sname
Generate_chance
PLAYER_INSTANCE
PK,FK1 Pid
PK,FK2 (Owner_pid, Wname)
Health
Hunger
Experience
Gamemode
Blocks_placed
Items_crafted
Distance_travelled
Time_played
Respawn_x
Respawn_y
Respawn_z
Current_x
Current_y
Current_z
WORLD
PK,FK Owner_pid
PK Wname
Spawn_x_coord
Spawn_y_coord
Spawn_z_coord
Def_gamemode
Difficulty
Tick_speed
Cheats
Create_year
Create_month
Create_date
Create_time
FRIENDSHIP
PK,FK1 Pid_1
PK,FK2 Pid_2
LOOT
PK,FK (Bname,Sname)
PK Item_id
Chance_of_finding
PLAYER_EFFECT
PK,FK (Pid,Owner_pid,Wname)
PK Effect_name
Duration
Description
INVENTORY
PK,FK (Pid,Owner_pid,Wname)
PK Item_id
Count
GAMERULE
PK,FK (Owner_pid, Wname)
PK Rule_name
Value

3. Conversion to 2NF:

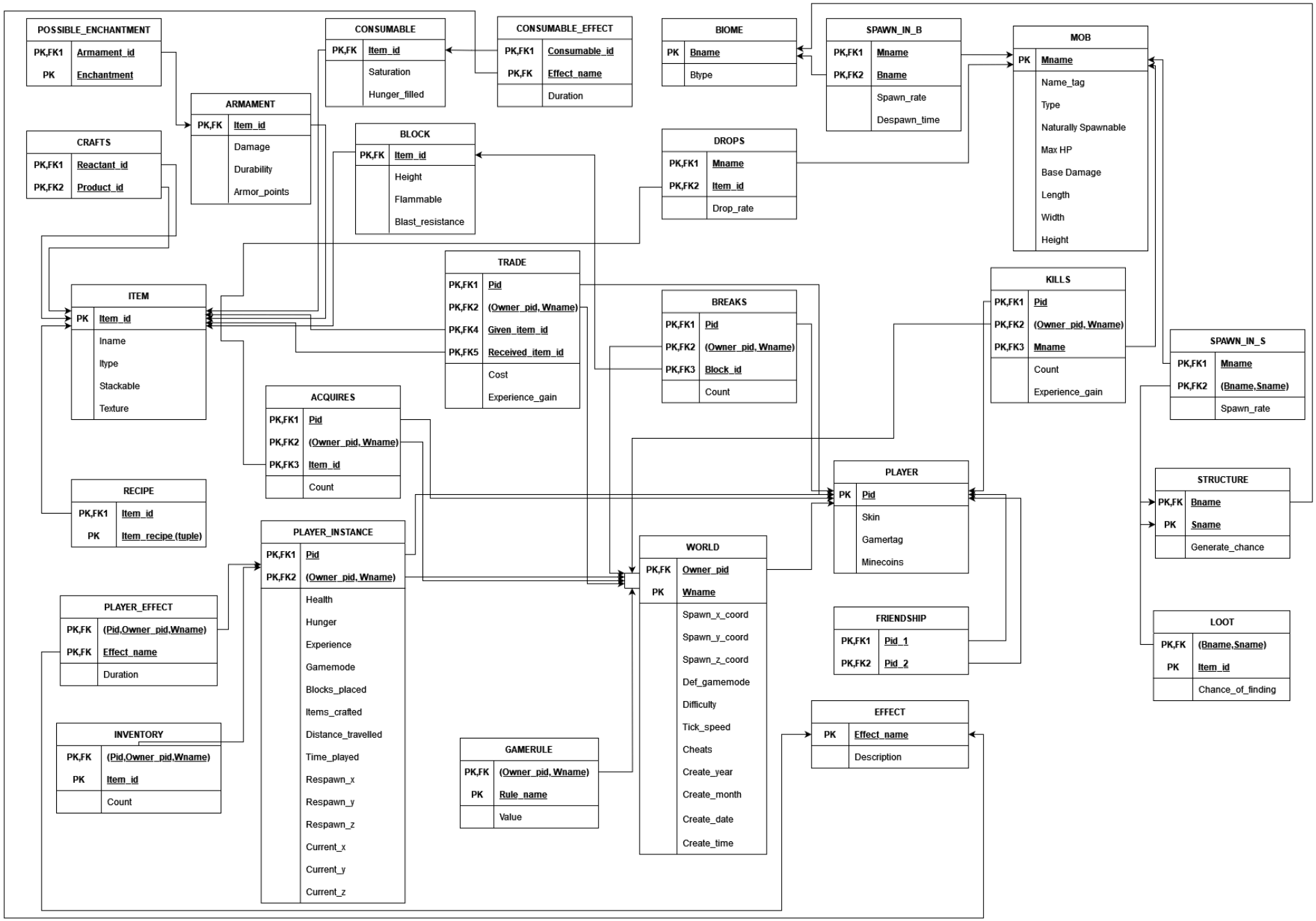
Removing Partial dependencies:

- The Effect Description (what the effect does) is functionally dependent on just the Effect_name and not the PLAYER affected by it or the CONSUMABLE that causes it. Thus Effect Description has been assigned as an attribute of the new EFFECT relation with the Effect_name as the primary key. The Effect_name is then referenced in the PLAYER_EFFECT and CONSUMABLE_EFFECT relations.
- The attributes of the TRADE relation aren't functionally dependent on the Mname component of the key and thus on second thought and thus have been removed.

4. Conversion to 3NF:

Removing Transitive dependencies:
The 2NF model obtained in the previous step is already in third normal form.
Our model met most requirements for 3NF from the onset, given the thoughtful structure of Minecraft's functional requirements. The efficiency of our design, which directly aligns with Minecraft's gameplay mechanics, may be reflective of the inherent structure in the game's world design, where each entity's properties and interactions follow logical groupings. This parallels database normalization principles, where data is structured to optimize storage and ensure clear, defined relationships.

On the following page is the representation of our model in 3NF, where we have maintained Minecraft's theme of order and meticulous data handling, much like how the game itself manages and represents resources, crafting materials, and interactions within its environment.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PK,FK Effect_name
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Btype
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PK,FK1 Mname
PK,FK2 Bname
Spawn_rate
Despawn_time
MOB
PK Mname
Name_tag
Type
Naturally Spawnable
Max HP
Base Damage
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Height
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Durability
Armor_points
CRAFTS
PK,FK1 Reactant_id
PK,FK2 Product_id
BLOCK
PK,FK Item_id
Height
Flammable
Blast_resistance
DROPS
PK,FK1 Mname
PK,FK2 Item_id
Drop_rate
ITEM
PK Item_id
Iname
Itype
Stackable
Texture
TRADE
PK,FK1 Pid
PK,FK2 (Owner_pid, Wname)
PK,FK4 Given_item_id
PK,FK5 Received_item_id
Cost
Experience_gain
BREAKS
PK,FK1 Pid
PK,FK2 (Owner_pid, Wname)
PK,FK3 Block_id
Count
KILLS
PK,FK1 Pid
PK,FK2 (Owner_pid, Wname)
PK,FK3 Mname
Count
Experience_gain
SPAWN_IN_S
PK,FK1 Mname
PK,FK2 (Bname,Sname)
Spawn_rate
ACQUIRES
PK,FK1 Pid
PK,FK2 (Owner_pid, Wname)
PK,FK3 Item_id
Count
RECIPE
PK,FK1 Item_id
PK Item_recipe (tuple)
PLAYER
PK Pid
Skin
Gamertag
Minecoins
STRUCTURE
PK,FK Bname
PK Sname
Generate_chance
PLAYER_INSTANCE
PK,FK1 Pid
PK,FK2 (Owner_pid, Wname)
Health
Hunger
Experience
Gamemode
Blocks_placed
Items_crafted
Distance_travelled
Time_played
Respawn_x
Respawn_y
Respawn_z
Current_x
Current_y
Current_z
WORLD
PK,FK Owner_pid
PK Wname
Spawn_x_coord
Spawn_y_coord
Spawn_z_coord
Def_gamemode
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Chance_of_finding
PLAYER_EFFECT
PK,FK (Pid,Owner_pid,Wname)
PK,FK Effect_name
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INVENTORY
PK,FK (Pid,Owner_pid,Wname)
PK Item_id
Count
GAMERULE
PK,FK (Owner_pid, Wname)
PK Rule_name
Value
EFFECT
PK Effect_name
Description