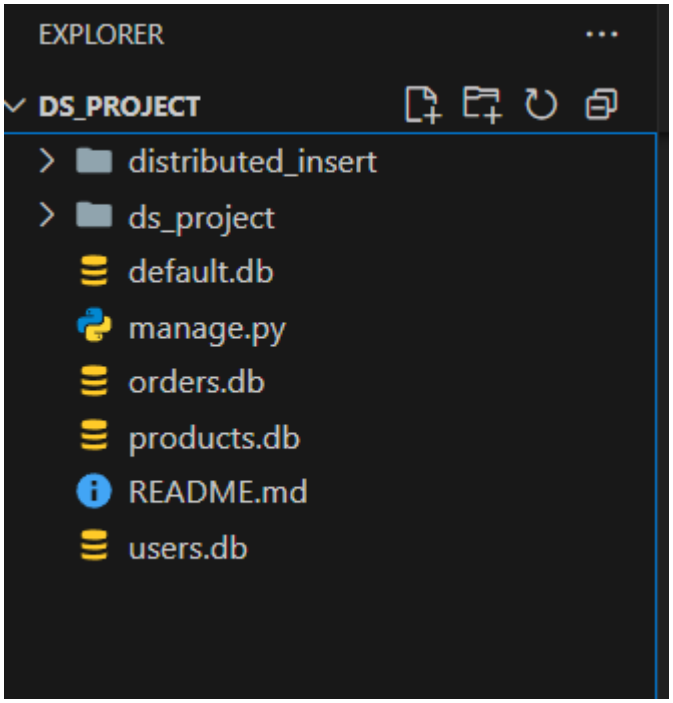
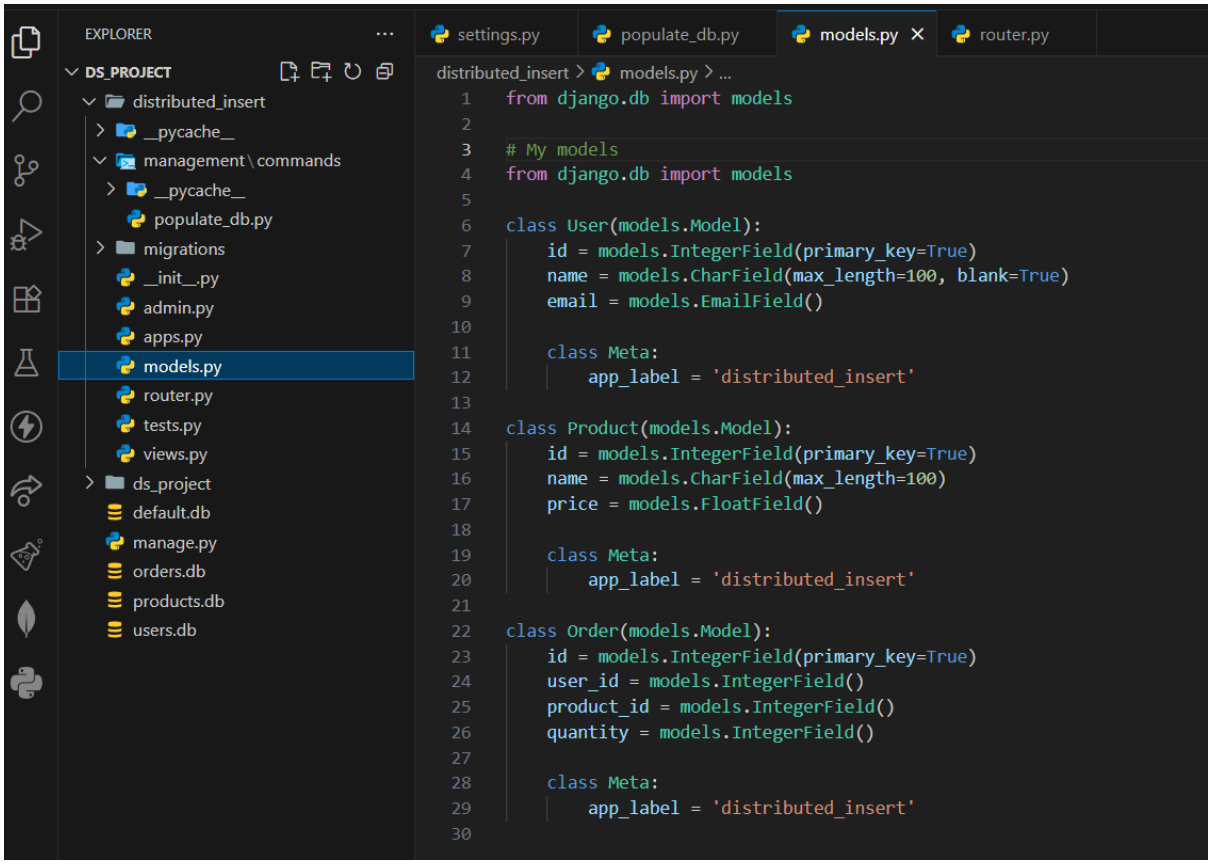
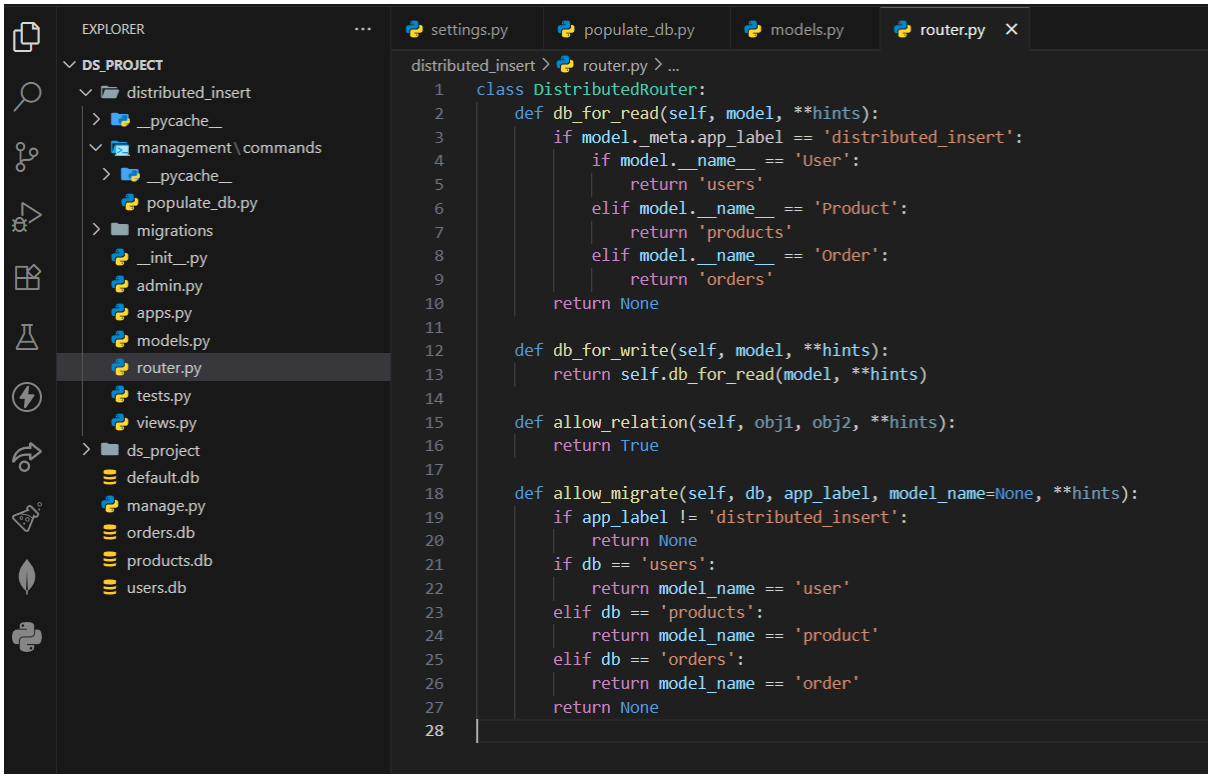
1.Project Structure:



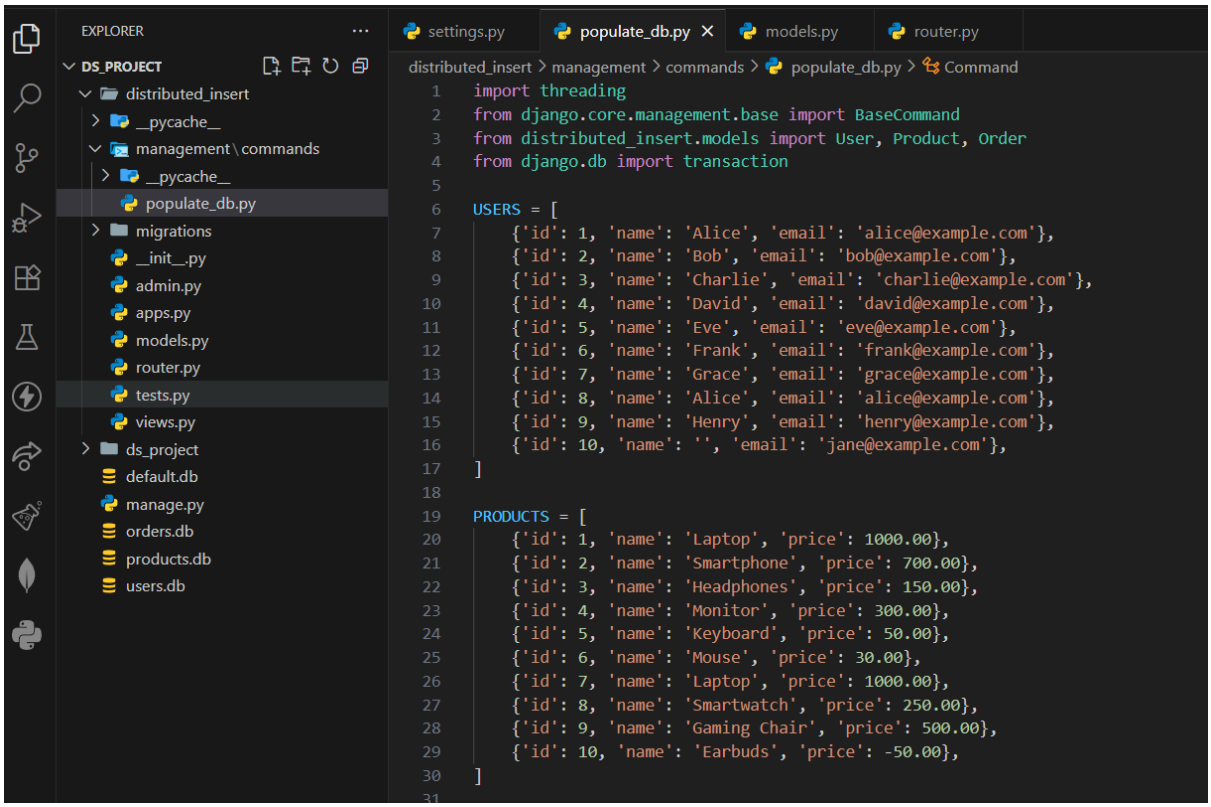
2. Django Models Definition:

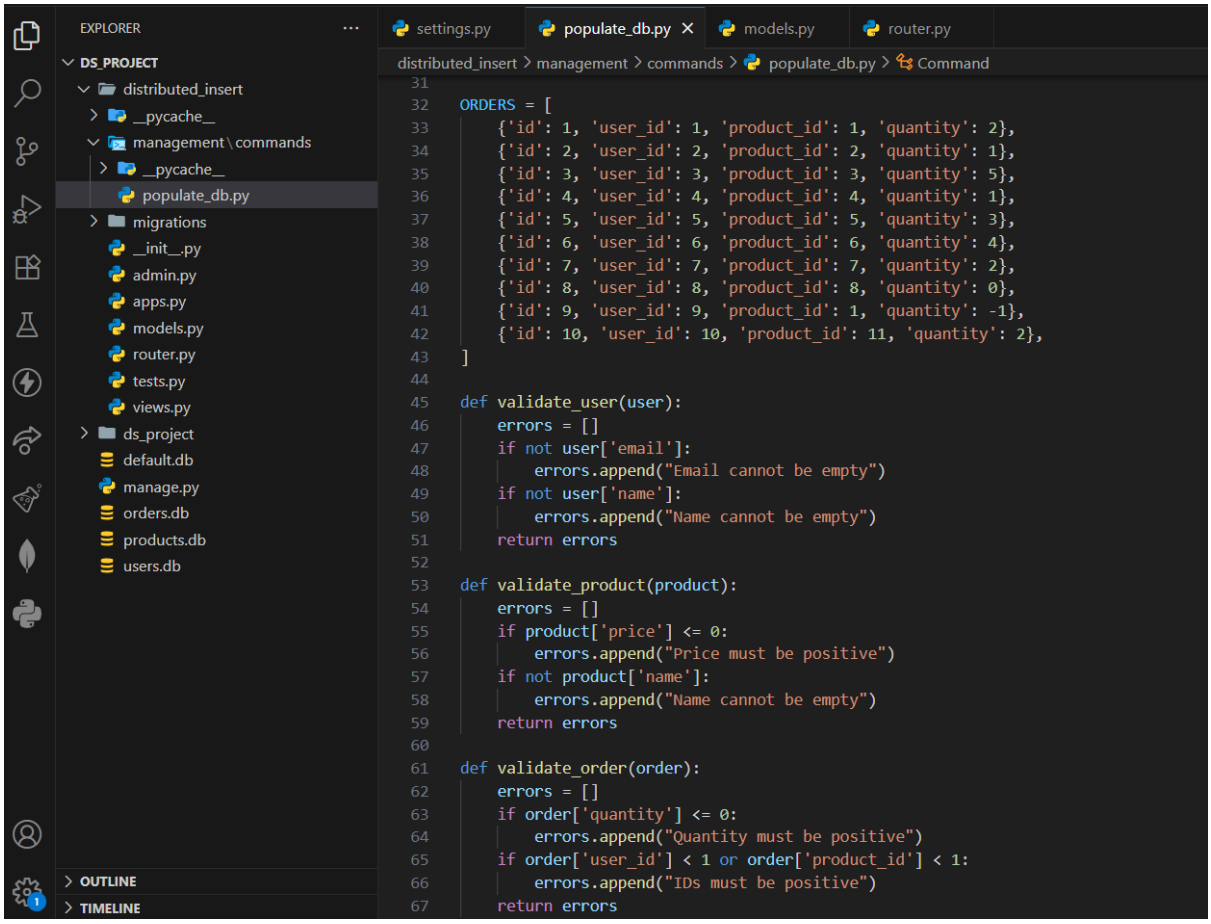


3. Database Router Implementation:

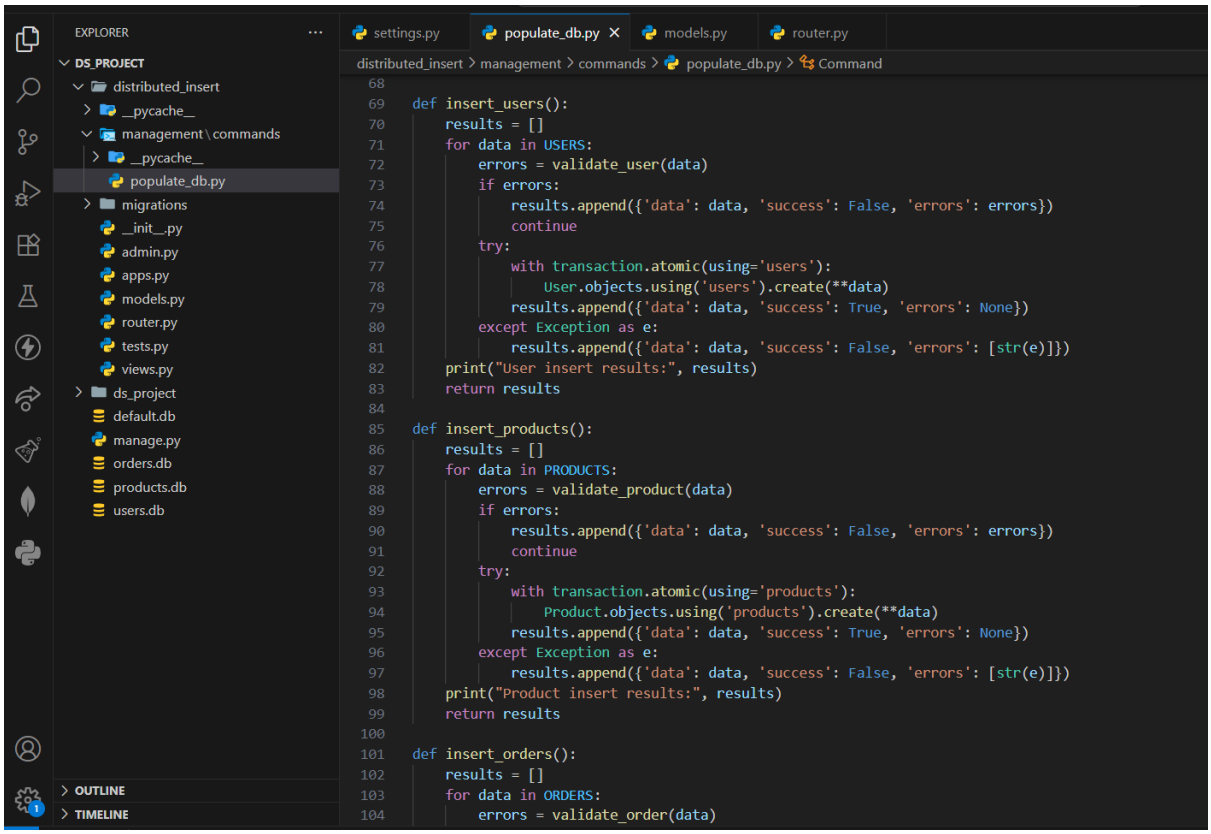


4. Sample Data Definition & Validate Logic:





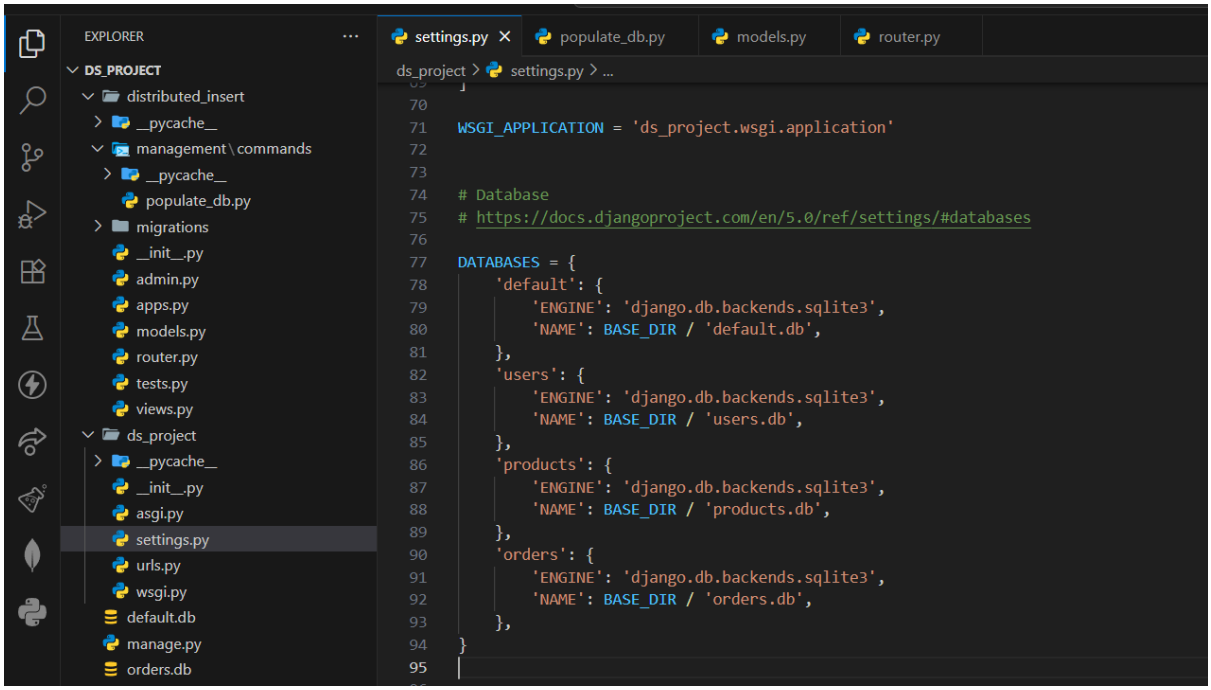
5. Threading Implementation



5.1 Threading Strategy:

- Three separate threads for concurrent execution
- Each thread handles one model's data independently
- Thread.join() ensures all operations complete before exit
- Atomic transactions ensure data consistency

6. Database Configuration:



7. Migration Process:

Step 1: Creating Migrations

```
PS C:\Users\Indrajeet\Desktop\ds_project> python manage.py makemigrations distributed_insert
>>
Migrations for 'distributed_insert':
  distributed_insert\migrations\0001_initial.py
    - Create model Order
    - Create model Product
    - Create model User
```

Step 2: Database-Specific Migrations

Users Database Migration:

```
PS C:\Users\Indrajeet\Desktop\ds_project> python manage.py migrate --database=users
Operations to perform:
  Apply all migrations: admin, auth, contenttypes, distributed_insert, sessions
Running migrations:
  Applying contenttypes.0001_initial... OK
  Applying auth.0001_initial... OK
  Applying admin.0001_initial... OK
  Applying admin.0002_logentry_remove_auto_add... OK
  Applying admin.0003_logentry_add_action_flag_choices... OK
  Applying contenttypes.0002_remove_content_type_name... OK
  Applying auth.0002_alter_permission_name_max_length... OK
  Applying auth.0003_alter_user_email_max_length... OK
  Applying auth.0004_alter_user_username_opts... OK
  Applying auth.0005_alter_user_last_login_null... OK
  Applying auth.0006_require_contenttypes_0002... OK
  Applying auth.0007_alter_validators_add_error_messages... OK
  Applying auth.0008_alter_user_username_max_length... OK
  Applying auth.0009_alter_user_last_name_max_length... OK
  Applying auth.0010_alter_group_name_max_length... OK
  Applying auth.0011_update_proxy_permissions... OK
  Applying auth.0012_alter_user_first_name_max_length... OK
  Applying distributed_insert.0001_initial... OK
  Applying sessions.0001_initial... OK
```

Products Database Migration:

```
PS C:\Users\Indrajeet\Desktop\ds_project> python manage.py migrate --database=products
Operations to perform:
  Apply all migrations: admin, auth, contenttypes, distributed_insert, sessions
Running migrations:
  Applying contenttypes.0001_initial... OK
  Applying auth.0001_initial... OK
  Applying admin.0001_initial... OK
  Applying admin.0002_logentry_remove_auto_add... OK
  Applying admin.0003_logentry_add_action_flag_choices... OK
  Applying contenttypes.0002_remove_content_type_name... OK
  Applying auth.0002_alter_permission_name_max_length... OK
  Applying auth.0003_alter_user_email_max_length... OK
  Applying auth.0004_alter_user_username_opts... OK
  Applying auth.0005_alter_user_last_login_null... OK
  Applying auth.0006_require_contenttypes_0002... OK
  Applying auth.0007_alter_validators_add_error_messages... OK
  Applying auth.0008_alter_user_username_max_length... OK
  Applying auth.0009_alter_user_last_name_max_length... OK
  Applying auth.0010_alter_group_name_max_length... OK
  Applying auth.0011_update_proxy_permissions... OK
  Applying auth.0012_alter_user_first_name_max_length... OK
  Applying distributed_insert.0001_initial... OK
  Applying sessions.0001_initial... OK
```

Orders Database Migration:

```
PS C:\Users\Indrajeet\Desktop\ds_project> python manage.py migrate --database=orders
Operations to perform:
  Apply all migrations: admin, auth, contenttypes, distributed_insert, sessions
Running migrations:
  Applying contenttypes.0001_initial... OK
  Applying auth.0001_initial... OK
  Applying admin.0001_initial... OK
  Applying admin.0002_logentry_remove_auto_add... OK
  Applying admin.0003_logentry_add_action_flag_choices... OK
  Applying contenttypes.0002_remove_content_type_name... OK
  Applying auth.0002_alter_permission_name_max_length... OK
  Applying auth.0003_alter_user_email_max_length... OK
  Applying auth.0004_alter_user_username_opts... OK
  Applying auth.0005_alter_user_last_login_null... OK
  Applying auth.0006_require_contenttypes_0002... OK
  Applying auth.0007_alter_validators_add_error_messages... OK
  Applying auth.0008_alter_user_username_max_length... OK
  Applying auth.0009_alter_user_last_name_max_length... OK
  Applying auth.0010_alter_group_name_max_length... OK
  Applying auth.0011_update_proxy_permissions... OK
  Applying auth.0012_alter_user_first_name_max_length... OK
  Applying distributed_insert.0001_initial... OK
```

Migration Strategy:

- Each database receives full Django migration set
- Model-specific tables created in designated databases
- Database router ensures proper table placement

Execution Results:

```
PROBLEMS    OUTPUT    DEBUG CONSOLE    TERMINAL    PORTS                                                    pwsh

PS C:\Users\Indrajeet\Desktop\ds_project> python manage.py populate_db
  >>
  Order insert results: [{'data': {'id': 1, 'user_id': 1, 'product_id': 1, 'quantity': 2}, 'success': True, 'errors': None}, {'data': {'id': 2, 'user_id': 2, 'product
  _id': 2, 'quantity': 1}, 'success': True, 'errors': None}, {'data': {'id': 3, 'user_id': 3, 'product_id': 3, 'quantity': 5}, 'success': True, 'errors': None}, {'dat
  a': {'id': 4, 'user_id': 4, 'product_id': 4, 'quantity': 1}, 'success': True, 'errors': None}, {'data': {'id': 5, 'user_id': 5, 'product_id': 5, 'quantity': 3}, 'su
  ccess': True, 'errors': None}, {'data': {'id': 6, 'user_id': 6, 'product_id': 6, 'quantity': 4}, 'success': True, 'errors': None}, {'data': {'id': 7, 'user_id': 7,
  'product_id': 7, 'quantity': 2}, 'success': True, 'errors': None}, {'data': {'id': 8, 'user_id': 8, 'product_id': 8, 'quantity': 0}, 'success': False, 'errors': ['Q
  uantity must be positive']}, {'data': {'id': 9, 'user_id': 9, 'product_id': 1, 'quantity': -1}, 'success': False, 'errors': ['Quantity must be positive']}, {'data':
   {'id': 10, 'user_id': 10, 'product_id': 11, 'quantity': 2}, 'success': True, 'errors': None}]
  User insert results: [{'data': {'id': 1, 'name': 'Alice', 'email': 'alice@example.com'}, 'success': True, 'errors': None}, {'data': {'id': 2, 'name': 'Bob', 'email'
  : 'bob@example.com'}, 'success': True, 'errors': None}, {'data': {'id': 3, 'name': 'Charlie', 'email': 'charlie@example.com'}, 'success': True, 'errors': None}, {'d
  ata': {'id': 4, 'name': 'David', 'email': 'david@example.com'}, 'success': True, 'errors': None}, {'data': {'id': 5, 'name': 'Eve', 'email': 'eve@example.com'}, 'su
  ccess': True, 'errors': None}, {'data': {'id': 6, 'name': 'Frank', 'email': 'frank@example.com'}, 'success': True, 'errors': None}, {'data': {'id': 7, 'name': 'Grac
  e', 'email': 'grace@example.com'}, 'success': True, 'errors': None}, {'data': {'id': 8, 'name': 'Alice', 'email': 'alice@example.com'}, 'success': True, 'errors': N
  one}, {'data': {'id': 9, 'name': 'Henry', 'email': 'henry@example.com'}, 'success': True, 'errors': None}, {'data': {'id': 10, 'name': '', 'email': 'jane@example.co
  m'}, 'success': False, 'errors': ['Name cannot be empty']}]
  Product insert results: [{'data': {'id': 1, 'name': 'Laptop', 'price': 1000.0}, 'success': True, 'errors': None}, {'data': {'id': 2, 'name': 'Smartphone', 'price':
  700.0}, 'success': True, 'errors': None}, {'data': {'id': 3, 'name': 'Headphones', 'price': 150.0}, 'success': True, 'errors': None}, {'data': {'id': 4, 'name': 'Mo
  nitor', 'price': 300.0}, 'success': True, 'errors': None}, {'data': {'id': 5, 'name': 'Keyboard', 'price': 50.0}, 'success': True, 'errors': None}, {'data': {'id':
  6, 'name': 'Mouse', 'price': 30.0}, 'success': True, 'errors': None}, {'data': {'id': 7, 'name': 'Laptop', 'price': 1000.0}, 'success': True, 'errors': None}, {'dat
  a': {'id': 8, 'name': 'Smartwatch', 'price': 250.0}, 'success': True, 'errors': None}, {'data': {'id': 9, 'name': 'Gaming Chair', 'price': 500.0}, 'success': True,
  'errors': None}, {'data': {'id': 10, 'name': 'Earbuds', 'price': -50.0}, 'success': False, 'errors': ['Price must be positive']}]
PS C:\Users\Indrajeet\Desktop\ds_project>
```

Final Output Analysis:

Concurrent Execution Results:

Orders Processing (8/10 successful):

- Orders 1-7: Successful insertions
- Order 8: Failed - Quantity = 0 (validation error)
- Order 9: Failed - Negative quantity (validation error)
- Order 10: Successful insertion

Users Processing (9/10 successful):

- Users 1-9: Successful insertions
- User 10: Failed - Empty name field (validation error)

Products Processing (9/10 successful):

- Products 1-9: Successful insertions
- Product 10: Failed - Negative price (validation error)

Performance Analysis:

- Total Records Processed: 30 records
- Successful Insertions: 26 records (86.7% success rate)
- Validation Failures: 4 records (13.3% - as expected)
- Concurrent Execution: All three threads ran simultaneously
- Zero Database Errors: All failures were application-level validation