Acknowledgments:

npm start Init
OUTPUT

```
PS C:\Users\apham\Assignment4> npm start Init

> Assignment4@0.0.1 start
> ts-node src/index.ts Init


Connecting to source & target databases...
Connected to MySQL
Connected to SQLite

 Initializing Analytics Database...

Verifying MySQL connection...
MySQL connection verified

 Initializing SQLite database...
Creating analytics tables...
Analytics tables created successfully

 Pre-populating date dimension...
Loaded 7670 dates
Date dimension populated

 Preparing sync state tracking...
Sync state table ready (0 entries)


INITIALIZATION COMPLETE
Analytics database is ready for data loading.
Next step: Run 'npm start full-load' to import data.


Closing connections
Connections closed
PS C:\Users\apham\Assignment4>
```

npm start Full-Load
OUTPUT

```
> Assignment4@0.0.1 start
> ts-node src/index.ts Full-Load



 Connecting to source & target databases...
Connected to MySQL
Connected to SQLite
```

🚀 Starting Full Load (Initial)...

Transaction started

Loading Dimensions...
Loaded 7670 dates
  Fetching all stores (initial load)
Loaded 2 stores
  Fetching all customers (initial load)
Loaded 599 customers
  Fetching all films (initial load)
Loaded 1000 films into DimFilm
  Fetching all actors (initial load)
  Loaded 200 actors
  Fetching all categories (initial load)
Loaded 16 categories

Loading Bridges...

=== BRIDGE FILM-ACTOR DEBUG ===
Source film_actor records: 5462
Target dim_film records: 1000
Target dim_actor records: 200

First 5 source film_actor records:
  actor_id: 1, film_id: 1
  actor_id: 1, film_id: 23
  actor_id: 1, film_id: 25
  actor_id: 1, film_id: 106
  actor_id: 1, film_id: 140

First 5 dim_film records:
  film_id: 1, film_key: 1
  film_id: 2, film_key: 2
  film_id: 3, film_key: 3
  film_id: 4, film_key: 4
  film_id: 5, film_key: 5

First 5 dim_actor records:
  actor_id: 1, actor_key: 1
  actor_id: 2, actor_key: 2
  actor_id: 3, actor_key: 3
  actor_id: 4, actor_key: 4
  actor_id: 5, actor_key: 5

Map sizes:
  filmKeyMap: 1000 entries
  actorKeyMap: 200 entries

Test lookups from first source record:
  Looking up film_id 1: 1
  Looking up actor_id 1: 1

=== RESULTS ===
Successful mappings: 5462
Missing film keys: 0
Missing actor keys: 0
Bridge records created: 5462
Loaded 5462 film-actor relationships
Loaded 1000 film-category relationships

Loading Facts...
  Fetching all rentals (initial load)
Loaded 16044 rental facts

Fetching all payments (initial load)
Loaded 16044 payment facts

 All operations completed
Transaction committed - Full load completed!

 Creating indexes...
Creating dimension indexes...
Creating fact table indexes...
Creating bridge table indexes...
All indexes created successfully

 Running Data Validation...

✅ Films   Source: 1000 | Target: 1000 | Diff: +0 (0.00%)
✅ Actors   Source: 200 | Target: 200 | Diff: +0 (0.00%)
✅ Categories   Source: 16 | Target: 16 | Diff: +0 (0.00%)
✅ Customers   Source: 599 | Target: 599 | Diff: +0 (0.00%)
✅ Stores   Source: 2 | Target: 2 | Diff: +0 (0.00%)
✅ Rentals   Source: 16044 | Target: 16044 | Diff: +0 (0.00%)
✅ Payments   Source: 16044 | Target: 16044 | Diff: +0 (0.00%)
✅ Film-Actor Links   Source: 5462 | Target: 5462 | Diff: +0 (0.00%)
✅ Film-Category Links Source: 1000 | Target: 1000 | Diff: +0 (0.00%)

☑️ Validating Aggregates:
──

Aggregate Validation Summary:
──

══
VALIDATION PASSED - All checks successful!
══

Closing connections
Connections closed

npm start Validate
OUTPUT

> Assignment4@0.0.1 start
> ts-node src/index.ts Validate

🖊 Connecting to source & target databases...
Connected to MySQL
Connected to SQLite

 Running Data Validation...

✅ Films   Source: 1000 | Target: 1000 | Diff: +0 (0.00%)
✅ Actors   Source: 200 | Target: 200 | Diff: +0 (0.00%)
✅ Categories   Source: 16 | Target: 16 | Diff: +0 (0.00%)
✅ Customers   Source: 599 | Target: 599 | Diff: +0 (0.00%)
✅ Stores   Source: 2 | Target: 2 | Diff: +0 (0.00%)
✅ Rentals   Source: 16044 | Target: 16044 | Diff: +0 (0.00%)
✅ Payments   Source: 16044 | Target: 16044 | Diff: +0 (0.00%)
✅ Film-Actor Links   Source: 5462 | Target: 5462 | Diff: +0 (0.00%)

☑ Film-Actor Links   Source: 5462 | Target: 5462 | Diff: +0 (0.00%)
☑ Film-Category Links   Source: 1000 | Target: 1000 | Diff: +0 (0.00%)

☑ Validating Aggregates:
_____

Aggregate Validation Summary:
_____

═══
VALIDATION PASSED - All checks successful!
═══

Closing connections
Connections closed

npm start Incremental
OUTPUT

> Assignment4@0.0.1 start
> ts-node src/index.ts Incremental

✏️ Connecting to source & target databases...
Connected to MySQL
Connected to SQLite

Starting Incremental Sync...
Sync started at: 2025-11-15T05:56:57.945Z

Syncing Dimensions...

Film:
 Fetching all films (initial load)
Loaded 1000 films into DimFilm

Actor:
 Fetching all actors (initial load)
 Loaded 200 actors

Category:
 Fetching all categories (initial load)
Loaded 16 categories

Customer:
 Fetching all customers (initial load)
Loaded 599 customers

Store:
 Fetching all stores (initial load)
Loaded 2 stores

Syncing Bridges...

Film-Actor:

=== BRIDGE FILM-ACTOR DEBUG ===
Source film_actor records: 5462
Target dim_film records: 1000
Target dim_actor records: 200

First 5 source film_actor records:
  actor_id: 1, film_id: 1
  actor_id: 1, film_id: 23
  actor_id: 1, film_id: 25
  actor_id: 1, film_id: 106
  actor_id: 1, film_id: 140

First 5 dim_film records:
  film_id: 1, film_key: 1
  film_id: 2, film_key: 2
  film_id: 3, film_key: 3
  film_id: 4, film_key: 4
  film_id: 5, film_key: 5

First 5 dim_actor records:
  actor_id: 1, actor_key: 1
  actor_id: 2, actor_key: 2
  actor_id: 3, actor_key: 3
  actor_id: 4, actor_key: 4
  actor_id: 5, actor_key: 5

Map sizes:
  filmKeyMap: 1000 entries
  actorKeyMap: 200 entries

Test lookups from first source record:
  Looking up film_id 1: 1
  Looking up actor_id 1: 1

=== RESULTS ===
Successful mappings: 5462
Missing film keys: 0
Missing actor keys: 0
Bridge records created: 5462
Loaded 5462 film-actor relationships

 Film-Category:
Loaded 1000 film-category relationships

 Syncing Facts...

 Rentals:
  Fetching all rentals (initial load)
Loaded 16044 rental facts

 Payments:
  Fetching all payments (initial load)
Loaded 16044 payment facts

 Updating sync state...

 Incremental sync completed successfully!
Sync finished at: 2025-11-15T05:57:00.308Z

 Running Data Validation...

✅ Films   Source: 1000 | Target: 1000 | Diff: +0 (0.00%)
✅ Actors   Source: 200 | Target: 200 | Diff: +0 (0.00%)
✅ Categories   Source: 16 | Target: 16 | Diff: +0 (0.00%)
✅ Customers   Source: 599 | Target: 599 | Diff: +0 (0.00%)
✅ Stores   Source: 2 | Target: 2 | Diff: +0 (0.00%)
✅ Rentals   Source: 16044 | Target: 16044 | Diff: +0 (0.00%)

✅ Rentals   Source: 16044 | Target: 16044 | Diff: +0 (0.00%)
✅ Payments   Source: 16044 | Target: 16044 | Diff: +0 (0.00%)
✅ Film-Actor Links   Source: 5462 | Target: 5462 | Diff: +0 (0.00%)
✅ Film-Category Links Source: 1000 | Target: 1000 | Diff: +0 (0.00%)

☑ Validating Aggregates:
_____

Aggregate Validation Summary:
_____

===
VALIDATION PASSED - All checks successful!
===

Closing connections
Connections closed

**Test
Output**

File	% Stmts	% Branch	% Funcs	% Lines	Uncovered Line #s
All files	74.43	48.16	85.5	73.53	
src	32.03	0	0	32.03	
data-source.ts	100	100	100	100	
data-target.ts	100	100	100	100	
index.ts	0	0	0	0	1-181
src/entity	0	100	100	0	
User.ts	0	100	100	0	1-16
src/entity/source	100	100	100	100	
Actor.ts	100	100	100	100	
Address.ts	100	100	100	100	
Category.ts	100	100	100	100	
City.ts	100	100	100	100	
Country.ts	100	100	100	100	
Customer.ts	100	100	100	100	
Film.ts	100	100	100	100	
FilmActor.ts	100	100	100	100	
FilmCategory.ts	100	100	100	100	
Inventory.ts	100	100	100	100	
Language.ts	100	100	100	100	
Payment.ts	100	100	100	100	
Rental.ts	100	100	100	100	
Staff.ts	100	100	100	100	
Store.ts	100	100	100	100	
src/entity/target	100	100	100	100	
BridgeFilmActor.ts	100	100	100	100	
BridgeFilmCategory.ts	100	100	100	100	
DimActor.ts	100	100	100	100	
DimCategory.ts	100	100	100	100	
DimCustomer.ts	100	100	100	100	
DimDate.ts	100	100	100	100	
DimFilm.ts	100	100	100	100	
DimStore.ts	100	100	100	100	
FactPayment.ts	100	100	100	100	
FactRental.ts	100	100	100	100	
SyncState.ts	100	100	100	100	
src/load	89.67	65.55	100	91	
loadBridgeFilmActor.ts	95.16	60	100	95	60,63,73
loadBridgeFilmCategory.ts	96.42	66.66	100	96.15	29
loadDimActor.ts	90	80	100	89.47	22-23
loadDimCategory.ts	80	60	100	78.94	14-15,23-24
loadDimCustomer.ts	80	63.63	100	78.94	22-23,31-32
loadDimDate.ts	100	83.33	100	100	27
loadDimFilm.ts	100	80	100	100	40
loadDimStore.ts	80	55.55	100	78.94	24-25,33-34

```
 loadFactPayment.ts      |   85.41 |     60 |    100 |  90.69 | 21-22,30-31
 loadFactRental.ts       |    87.5 |  66.66 |    100 |     92 | 23-24,31-32
src/sync                 |   52.25 |  31.86 |  68.18 |  52.66 |
 createIndexes.ts        |       0 |      0 |      0 |      0 | 1-188
 incrementalSync.ts      |       0 |      0 |      0 |      0 | 3-93
 initAnalytics.ts        |   84.84 |     50 |    100 |  84.84 | 40-44
 syncStateManager.ts     |   38.88 |     25 |   37.5 |  43.75 | 30-57
 validateData.ts         |   86.98 |     50 |    100 |  89.13 | 134-136,138-139,146-
147,162,164,199,201,248,250,300,302
 src/utilities           |     100 |    100 |    100 |    100 |
  dateUtils.ts           |     100 |    100 |    100 |    100 |
--------------------------|---------|----------|---------|---------|-----------------------------------------------------
Test Suites: 5 failed, 5 total
Tests:       3 failed, 9 passed, 12 total
Snapshots:   0 total
Time:        14.047 s
Ran all test suites.
```