Solution Practice Set 6

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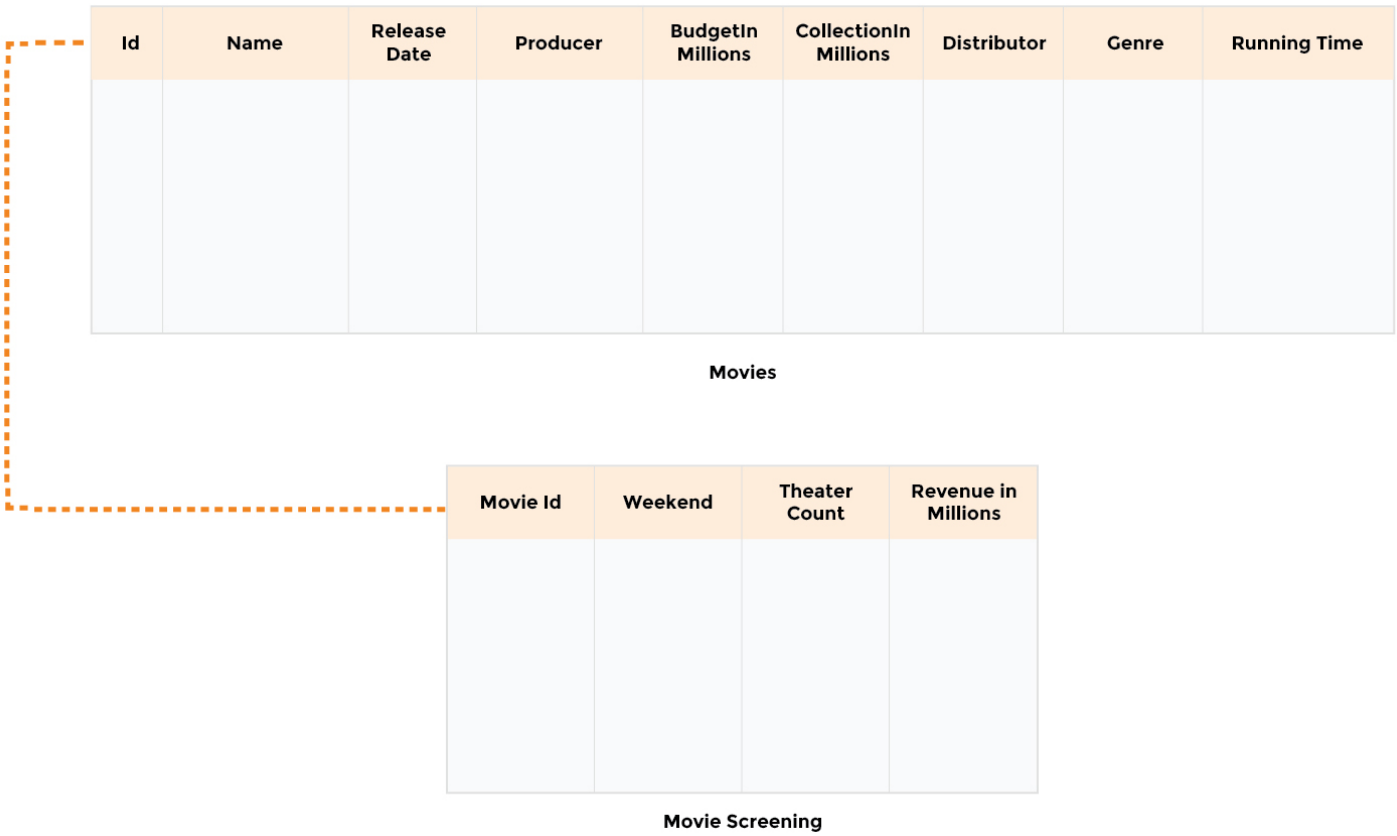
The database relationship model is reprinted below for reference.



> Connect to the terminal below by clicking in the widget. Once connected, the command line prompt will show up. Enter or copy and paste the command **./DataJek/Lessons/quiz2.sh** and wait for the MySQL prompt to start-up.

```
-- The lesson queries are reproduced below for convenient copy/paste into the terminal.

-- Question # 1, Query 1
SELECT Distributor, COUNT(Id) FROM Movies
GROUP BY Distributor
HAVING COUNT(Id) > 1
ORDER BY 2 DESC;
```

```sql
-- Question # 1, Query 2
SELECT y.Distributor, y.Name, y.CollectionInMillions

FROM (
       SELECT Distributor, COUNT(Id)
       FROM Movies
       GROUP BY Distributor
       HAVING COUNT(Id) > 1
       ORDER BY 2 DESC
     ) AS x
INNER JOIN Movies y
ON y.Distributor = x.Distributor;

-- Question # 1, Query 3
SELECT y.Distributor, y.Name, y.CollectionInMillions
FROM (
        SELECT Distributor, COUNT(Id)
        FROM Movies
        GROUP BY Distributor
        HAVING COUNT(Id) > 1
        ORDER BY 2 DESC
     ) AS x
INNER JOIN Movies y
ON y.Distributor = x.Distributor
ORDER BY y.Distributor, y.CollectionInMillions DESC;

-- Question # 1, Query 4
SET @dist_rank := 0, @current_dist := '';

SELECT y.Distributor, y.Name, y.CollectionInMillions,
       @dist_rank := IF(@current_dist = y.Distributor, @dist_rank + 1, 1) AS distributor_rank,
       @current_dist := y.Distributor AS dummy
FROM (
        SELECT Distributor, COUNT(Id)
        FROM Movies
        GROUP BY Distributor
        HAVING COUNT(Id) > 1
        ORDER BY 2 DESC
       ) AS x
INNER JOIN Movies y
ON y.Distributor = x.Distributor
ORDER BY y.Distributor, y.CollectionInMillions DESC;

-- Question # 1, Query 5
SELECT Distributor, Name AS Movie, CollectionInMillions, distributor_rank AS Rank
FROM (
        SELECT y.Distributor, y.Name, y.CollectionInMillions,
        @dist_rank := IF(@current_dist = y.Distributor, @dist_rank + 1, 1) AS distributor_rank,
        @current_dist := y.Distributor AS dummy
        FROM (
              SELECT Distributor, COUNT(Id)
              FROM Movies
              GROUP BY Distributor
              HAVING COUNT(Id) > 1
              ORDER BY 2 DESC
             ) AS x
        INNER JOIN Movies y
        ON y.Distributor = x.Distributor
        ORDER BY y.Distributor, y.CollectionInMillions DESC
      ) as z
WHERE distributor_rank <= 2;
```

```sql
-- Question # 1, Query 6
( SELECT Distributor,  Name AS Movie, CollectionInMillions
  FROM   Movies
  WHERE  Distributor = 'Paramount Pictures'
  ORDER BY CollectionInMillions DESC
  LIMIT 2)
UNION
( SELECT Distributor,  Name AS Movie, CollectionInMillions
  FROM   Movies
  WHERE  Distributor = 'Warner Bros'
  ORDER BY CollectionInMillions DESC
  LIMIT 2);

-- Question # 2, Query 1
SELECT 'Total' AS Name, SUM(BudgetInMillions) AS BudgetInMillions, SUM(CollectionInMillions) AS Co
FROM Movies
UNION
SELECT 'Average',  AVG(BudgetInMillions), AVG(CollectionInMillions) FROM Movies
UNION
SELECT 'Minimum', MIN(BudgetInMillions), MIN(CollectionInMillions) FROM Movies
UNION
SELECT 'Maximum', MAX(BudgetInMillions), MAX(CollectionInMillions) FROM Movies;

-- Question # 2, Query 2
SELECT 'Total' AS Name, SUM(BudgetInMillions) AS BudgetInMillions, SUM(CollectionInMillions) AS Co
FROM Movies
UNION
SELECT 'Average',  AVG(BudgetInMillions), AVG(CollectionInMillions) FROM Movies
UNION
SELECT 'Minimum', MIN(BudgetInMillions), MIN(CollectionInMillions) FROM Movies
UNION
SELECT 'Maximum', MAX(BudgetInMillions), MAX(CollectionInMillions) FROM Movies
UNION
SELECT Name, BudgetInMillions, CollectionInMillions FROM Movies;

-- Question # 3, Query 1
SELECT @row_num := @row_num + 1 AS rownum, RunningTime
FROM Movies, (SELECT @row_num := 0)x
ORDER BY RunningTime;

-- Question # 3, Query 2
SELECT ROUND(AVG(RunningTime),1) As Median
FROM (
      SELECT @row_num := @row_num + 1 as rownum, RunningTime
      FROM Movies, (SELECT @row_num := 0)x
      ORDER BY RunningTime
     )m
WHERE  m.rownum IN( FLOOR( (@row_num+1)/2), CEIL( (@row_num+1)/2) );

-- Question # 3, Query 3
SELECT RunningTime, Count(*) AS Frequency
FROM Movies
GROUP BY RunningTime
ORDER BY Frequency DESC;

-- Question # 3, Query 4
SELECT RunningTime, Count(*) AS Frequency
FROM Movies
GROUP BY RunningTime
HAVING Count(*) >= ALL (SELECT Count(*) FROM Movies GROUP BY RunningTime);

-- Question # 3, Query 5
```

```
SELECT 'Mean'  AS 'Measure' , ROUND(AVG(RunningTime),1) AS  'Value'
FROM Movies
UNION
SELECT 'Median', ROUND(AVG(RunningTime),1)
FROM (
    SELECT @row_num := @row_num + 1 as rownum, RunningTime
    FROM Movies, (SELECT @row_num := 0)x
    ORDER BY RunningTime
    )m
WHERE  m.rownum IN( FLOOR( (@row_num+1)/2), CEIL( (@row_num+1)/2) )
UNION
SELECT 'Mode', GROUP_CONCAT(RunningTime)
FROM(
           SELECT RunningTime, Count(*) AS Frequency
           FROM Movies
           GROUP BY RunningTime
           HAVING Count(*) >= ALL
                     (SELECT Count(*)    FROM Movies   GROUP BY RunningTime)
  )m;

-- Question # 4, Query 1
SELECT @av_budget := AVG(BudgetInMillions),
       @av_collection := AVG(CollectionInMillions),
       @av_time := AVG(RunningTime),
       @stdv_budget := STDDEV_SAMP(BudgetInMillions),
       @stdv_collection := STDDEV_SAMP(CollectionInMillions),
       @stdv_time := STDDEV_SAMP(RunningTime)
FROM Movies;

-- Question # 4, Query 2
SELECT 'BudgetInMillions' AS Row, 'BudgetInMillions' AS Col,
        ROUND(SUM( ( BudgetInMillions - @av_budget ) * (BudgetInMillions - @av_budget) ) / ((COUNT
FROM Movies
UNION
SELECT 'BudgetInMillions' AS Row, 'CollectionInMillions' AS Col,
        ROUND( SUM( ( BudgetInMillions - @av_budget ) * (CollectionInMillions - @av_collection) ) /
FROM Movies
UNION
SELECT 'BudgetInMillions' AS Row, 'RunningTime' AS Col,
        ROUND( SUM( ( BudgetInMillions - @av_budget ) * (RunningTime - @av_time) ) / ((COUNT(Budge
FROM Movies
UNION
SELECT 'CollectionInMillions' AS Row, 'BudgetInMillions' AS Col,
        ROUND( SUM( ( CollectionInMillions - @av_collection ) * (BudgetInMillions - @av_budget) ) /
FROM Movies
UNION
SELECT 'CollectionInMillions' AS Row, 'CollectionInMillions' AS Col,
        ROUND( SUM( ( CollectionInMillions - @av_collection ) * (CollectionInMillions - @av_collec
FROM Movies
UNION
SELECT 'CollectionInMillions' AS Row, 'RunningTime' AS Col,
        ROUND( SUM( ( CollectionInMillions - @av_collection ) * (RunningTime - @av_time) ) / ((COU
FROM Movies
UNION
SELECT 'RunningTime' AS Row, 'BudgetInMillions' AS Col,
        ROUND( SUM( ( RunningTime - @av_time ) * (BudgetInMillions - @av_budget) ) / ((COUNT(Runni
FROM Movies
UNION
SELECT 'RunningTime' AS Row, 'CollectionInMillions' AS Col,
        ROUND( SUM( ( RunningTime - @av_time ) * (CollectionInMillions - @av_collection) ) / ((COU
FROM Movies
UNION
```

```
SELECT 'RunningTime' AS Row, 'RunningTime' AS Col,
       ROUND( SUM( ( RunningTime - @av_time ) * (RunningTime - @av_time) ) / ((COUNT(RunningTime)
FROM Movies;

--Question # 4, Query 3
SELECT Row,
SUM(CASE WHEN Col='BudgetInMillions' THEN Correlation ELSE 0 END) AS Budget,
SUM(CASE WHEN Col='CollectionInMillions' THEN Correlation ELSE 0 END) AS Collection,
SUM(CASE WHEN Col='RunningTime' THEN Correlation ELSE0 END) AS RunningTime
FROM (
       SELECT 'BudgetInMillions' AS Row, 'BudgetInMillions' AS Col,
              ROUND(SUM( ( BudgetInMillions - @av_budget ) * (BudgetInMillions - @av_budget) ) /
       FROM Movies
       UNION
       SELECT 'BudgetInMillions' AS Row, 'CollectionInMillions' AS Col,
             ROUND( SUM( ( BudgetInMillions - @av_budget ) * (CollectionInMillions - @av_collect
       FROM Movies
       UNION
       SELECT 'BudgetInMillions' AS Row, 'RunningTime' AS Col,
              ROUND( SUM( ( BudgetInMillions - @av_budget ) * (RunningTime - @av_time) ) / ((COU
       FROM Movies
       UNION
       SELECT 'CollectionInMillions' AS Row, 'BudgetInMillions' AS Col,
              ROUND( SUM( ( CollectionInMillions - @av_collection ) * (BudgetInMillions - @av_bu
       FROM Movies
       UNION
       SELECT 'CollectionInMillions' AS Row, 'CollectionInMillions' AS Col,
             ROUND( SUM( ( CollectionInMillions - @av_collection ) * (CollectionInMillions - @av_
       FROM Movies
       UNION
       SELECT 'CollectionInMillions' AS Row, 'RunningTime' AS Col,
              ROUND(SUM( ( CollectionInMillions - @av_collection ) * (RunningTime - @av_time) ) /
       FROM Movies
       UNION
       SELECT 'RunningTime' AS Row, 'BudgetInMillions' AS Col,
              ROUND( SUM( ( RunningTime - @av_time ) * (BudgetInMillions - @av_budget) ) / ((COU
       FROM Movies
       UNION
       SELECT 'RunningTime' AS Row, 'CollectionInMillions' AS Col,
              ROUND( SUM( ( RunningTime - @av_time ) * (CollectionInMillions - @av_collection) )
       FROM Movies
       UNION
       SELECT 'RunningTime' AS Row, 'RunningTime' AS Col,
              ROUND( SUM( ( RunningTime - @av_time ) * (RunningTime - @av_time) ) / ((COUNT(Runn
       FROM Movies
       ) T
GROUP BY Row
ORDER BY Row;

-- Question # 5, Query 1
SELECT Distributor, SUM(CollectionInMillions)
FROM Movies
GROUP BY Distributor
ORDER BY 2 DESC
LIMIT 3;

-- Question # 5, Query 2
CREATE TEMPORARY TABLE T1(
                          SELECT Distributor, SUM(CollectionInMillions)
                          FROM Movies
                          GROUP BY Distributor
                          ORDER BY 2 DESC
```

```
                          LIMIT 3);

-- Question # 5, Query 3
CREATE TEMPORARY TABLE T2
SELECT * FROM T1;

SELECT * FROM T1
UNION
SELECT 'All Others' as Distributor, SUM(CollectionInMillions)
FROM Movies
WHERE Distributor NOT IN (SELECT Distributor
                          FROM T2);
```

Terminal

Question # 1

Find the top two movies of distributors who have more than one movie to their name.

First we'll check our **Movies** table for information on Distributors:

```
SELECT Distributor, COUNT(Id) FROM Movies
GROUP BY Distributor
HAVING COUNT(Id) > 1
ORDER BY 2 DESC;
```

We have two distributors with more than one movie in our table; *Paramount Pictures* and *Warner Bros* with three movies each.

Next we will find the movies of these distributors. We need to join the results of the previous query with the **Movies** table:

```
SELECT y.Distributor, y.Name, y.CollectionInMillions
FROM (
      SELECT Distributor, COUNT(Id)
      FROM Movies
      GROUP BY Distributor
      HAVING COUNT(Id) > 1
      ORDER BY 2 DESC
     ) AS x
```

```
INNER JOIN Movies y
ON y.Distributor = x.Distributor;
```

This query lists all the movies from distributors who meet our criterion of having more than one movie in the table. We are a step closer to finding the top two movies of each distributor.

Now we need **ORDER BY** clause to put the results in order according to **CollectionInMillions**:

```
SELECT y.Distributor, y.Name, y.CollectionInMillions
FROM (
      SELECT Distributor, COUNT(Id)
      FROM Movies
      GROUP BY Distributor
      HAVING COUNT(Id) > 1
      ORDER BY 2 DESC
     ) AS x
INNER JOIN Movies y
ON y.Distributor = x.Distributor
ORDER BY y.Distributor, y.CollectionInMillions DESC;
```

To find the top two movies, we need to rank the rows returned by the previous query. For older versions of MySQL which do not support the **ROW_NUMBER()** function, it can be emulated using session variables.

The **@current_dist** variable is updated in each iteration as ***@current_dist := y.Distributor AS dummy***. The variable **@dist_rank** is incremented if **@current_dist** is the same, otherwise it is reset to 1.

@dist_rank := IF(@current_dist = y.Distributor, @dist_rank + 1, 1)

We will initialize the session variables and use them in the previously created query as follows:

```
SET @dist_rank := 0, @current_dist := '';

SELECT y.Distributor, y.Name, y.CollectionInMillions,
       @dist_rank := IF(@current_dist = y.Distributor, @dist_rank + 1, 1)
AS distributor_rank,
```

```
       @current_dist := y.Distributor AS dummy
FROM (

      SELECT Distributor, COUNT(Id)
      FROM Movies
      GROUP BY Distributor
      HAVING COUNT(Id) > 1
      ORDER BY 2 DESC
     ) AS x
INNER JOIN Movies y
ON y.Distributor = x.Distributor
ORDER BY y.Distributor, y.CollectionInMillions DESC;
```

Two more columns are added to the result set and we have now numbered the rows.

The last step is selecting the top 2 rows based on the ranking. We will use the above query as a subquery:

```
SELECT Distributor, Name AS Movie,
       CollectionInMillions, distributor_rank AS Rank
FROM (
      SELECT y.Distributor, y.Name, y.CollectionInMillions,
      @dist_rank := IF(@current_dist = y.Distributor, @dist_rank + 1, 1) A
S distributor_rank,
      @current_dist := y.Distributor AS dummy
      FROM (
            SELECT Distributor, COUNT(Id)
            FROM Movies
            GROUP BY Distributor
            HAVING COUNT(Id) > 1
            ORDER BY 2 DESC
           ) AS x
      INNER JOIN Movies y
      ON y.Distributor = x.Distributor
      ORDER BY y.Distributor, y.CollectionInMillions DESC
    ) as z
WHERE distributor_rank <= 2;
```

This is not the most optimal query because of the number of sub-queries and joins but it serves our purpose of dynamically selecting groups with more than

one entry in the table and then finding the top two rows from those groups. A much cleaner and better performing query uses **UNION** as follows:

```
(
  SELECT Distributor,  Name AS Movie, CollectionInMillions
  FROM   Movies
  WHERE  Distributor = 'Paramount Pictures'
  ORDER BY CollectionInMillions DESC
  LIMIT 2
)
UNION
(
  SELECT Distributor,  Name AS Movie, CollectionInMillions
  FROM   Movies
  WHERE  Distributor = 'Warner Bros'
  ORDER BY CollectionInMillions DESC
  LIMIT 2
);
```

Here we are ordering the movies according to their **CollectionInMillions** and then limiting those results to top two. **UNION** then combines all the results. The drawback with this query is that we have to manually specify the **Distributors** we want in the result set. This is not a problem with only two distributors but it's not hard to imagine what will happen if the number of distributors who meet our criterion is large.

Using the analytic **ROW_NUMBER()** function, this question can be solved without using any session variables. The sub-query in our solution becomes:

```
SELECT Distributor,  Name AS Movie, CollectionInMillions,
       ROW_NUMBER() OVER(PARTITION BY Distributor ORDER BY RevenueInMillio
ns DESC) AS movie_rank
FROM   Movies
```

The above query will return the **Movies** tables numbered according to distributors. Next step is to select only those who have more than one movie to their credit. We will join the results of the query above with the one we created in the first step as follows:

```
SELECT x.Distributor, Name AS Movie, CollectionInMillions, movie_rank
FROM
```

```
(
  SELECT Distributor,  Name AS Movie, CollectionInMillions,

  ROW_NUMBER() OVER(PARTITION BY Distributor ORDER BY RevenueInMillions DE
SC) as movie_rank
  FROM   Movies) x

  JOIN

  (SELECT Distributor, Count(MovieID)
  FROM Movies
  GROUP BY Distributor
  HAVING COUNT(MovieID) > 1
  ) y

  ON x.Distributor = y.Distributor
)
WHERE movie_rank <=2;
```

Question # 2

Find the total, average, minimum and maximum of the production budget and revenue earned from the Movies table and append the summary data to the top of the table.

Summary tables provide a quick look into the data when the tables are large or contain a lot of numerical values. Summary statistics include sum, average, maximum, and minimum. Maximum and minimum show the degree of variability of the values in the columns.

We can calculate summary statistics for the **BudgetInMillions** and **CollectionInMillions** columns using four separate queries and join the results using **UNION** clause as follows:

```
SELECT 'Total' AS Name, SUM(BudgetInMillions) AS BudgetInMillions, SUM(Col
lectionInMillions) AS CollectionInMillions
FROM Movies

UNION
```

```
SELECT 'Average', AVG(BudgetInMillions), AVG(CollectionInMillions) FROM Mo
vies

UNION

SELECT 'Minimum', MIN(BudgetInMillions), MIN(CollectionInMillions) FROM Mo
vies

UNION

SELECT 'Maximum', MAX(BudgetInMillions), MAX(CollectionInMillions) FROM Mo
vies;
```

If we want the summary stats to appear before the table rows, we can simply join another query to the above using UNION clause:

```
SELECT 'Total' AS Name, SUM(BudgetInMillions) AS BudgetInMillions, SUM(Col
lectionInMillions) AS CollectionInMillions
FROM Movies

UNION

SELECT 'Average', AVG(BudgetInMillions),  AVG(CollectionInMillions) FROM M
ovies

UNION

SELECT 'Minimum', MIN(BudgetInMillions), MIN(CollectionInMillions) FROM Mo
vies

UNION

SELECT 'Maximum', MAX(BudgetInMillions), MAX(CollectionInMillions) FROM Mo
vies

UNION

SELECT Name, BudgetInMillions, CollectionInMillions FROM Movies;
```

Summary statistics help identify outliers in the data. More summary statistics

include standard deviation and variance which show outliers in the data. They

can be calculated using the **STDEV_SAMP()** and **VAR_SAMP()** function.

Question # 3

Calculate the mean median and mode of the running time of movies.

Mean, median, and mode are measures of the central value of the data. Mean can be calculated using the **AVG()** function. For median and mode we need separate queries.

To calculate the median which is the middle value, we first need to number the rows. This will establish if the median is a single value or average of two middle values. We will sort the numbered rows according to the **RunningTime**.

```
SELECT @row_num := @row_num + 1 AS rownum, RunningTime
FROM Movies, (SELECT @row_num := 0)x
ORDER BY RunningTime;
```

Median is the value at the middle row. We will use **FLOOR()** and **CEIL()** functions to find the middle rows and take average of the two values to find the median The following query finds the median of the **RunningTime** column:

```
SELECT ROUND(AVG(RunningTime),1) As Median
FROM (
      SELECT @row_num := @row_num + 1 as rownum, RunningTime
      FROM Movies, (SELECT @row_num := 0)x
      ORDER BY RunningTime
    )m
WHERE  m.rownum IN( FLOOR( (@row_num+1)/2), CEIL( (@row_num+1)/2) );
```

The **WHERE** clause selects one or two rows based on whether the **@row_num** is odd or even. Our table has 11 rows and the middle row is row 6. To get the correct answer we need to add 1 to the **@row_num** variable making it 12. Thus ***FLOOR(@row_num+1/2)*** will be 6 and ***CEIL(@row_num+1/2)*** will also be 6. The **WHERE** clause evaluates to **WHERE m.@row_num IN(6, 6)**

In case the number of rows were 10, the median would have been the average of rows 5 and 6. In that scenario, adding 1 to **@row_num** would give us 11 and ***FLOOR(@row_num+1/2)*** would evaluate to 5 while ***CEIL(@row_num+1/2)*** would evaluate to 6. The **WHERE** clause would become **WHERE m.@row_num IN(5 ,6)**

Mode is the most frequently occurring value in data. It can be calculated by grouping data and then finding the highest occurring value. There can be more than one mode values in data.

Frequency of occurrence can be calculated as:

```
SELECT RunningTime, Count(*) AS Frequency
FROM Movies
GROUP BY RunningTime
ORDER BY Frequency DESC;
```

We have two values that occur more frequently than others. To find the highest occurring value/ values in the data, we need a HAVING clause with the above query as follows:

```
SELECT RunningTime, Count(*) AS Frequency
FROM Movies
GROUP BY RunningTime
HAVING Count(*) >= ALL
   (SELECT Count(*) FROM Movies GROUP BY RunningTime);
```

Finally by combining the queries for mean, median, and mode we get:

```
SELECT 'Mean' AS 'Measure', ROUND(AVG(RunningTime),1) AS 'Value'
FROM Movies

UNION

SELECT 'Median', ROUND(AVG(RunningTime),1)
FROM (
    SELECT @row_num := @row_num + 1 as rownum, RunningTime
    FROM Movies, (SELECT @row_num := 0)x
    ORDER BY RunningTime
    )m
WHERE  m.rownum IN( FLOOR( (@row_num+1)/2), CEIL( (@row_num+1)/2) )

UNION

SELECT 'Mode', GROUP_CONCAT(RunningTime)
FROM(
          SELECT RunningTime, Count(*) AS Frequency
          FROM Movies
          GROUP BY RunningTime
          HAVING Count(*) >= ALL
                    (SELECT Count(*)    FROM Movies   GROUP BY RunningTim
e)
  )m;
```

Question # 4

Find the correlation between budget, collection and running time of movies and display the results as a table.

To make sense of number columns in a table, correlation is calculated which shows the relationship between two variables. Two variables are said to be correlated if change in value of one variable causes the other to change in a specific manner.

Scatter-plots provide a glimpse of the relationship between two variables. Correlation represents all points on a scatter-plot as a single value which can be between -1 and 1. Correlation has two factors: strength and direction.

be between -1 and 1. Correlation has two factors: strength and direction. *Strength* is how much one variable changes with respect to another. The value

of 1 and -1 show a linear relationship meaning that when one variable changes the other also changes on a consistent rate. 0 shows no relationship whatsoever. Values that fall between 0 and 1 or -1 show the strength of the relationship as being weak or strong. The second factor, *direction* of the relationship shows that when one variable increases the other increases or decreases.

Keeping the above discussion in mind, if we view the movie budget and collection values as a scatter-plot, we can spot a linear relationship. However there is no visible relationship between budget and running time of the movie:

By definition Pearson Correlation is expressed as:

$$\frac{Degree\ to\ which\ X\ and\ Y\ vary\ together}{Degree\ to\ which\ X\ and\ Y\ vary\ separately}$$

Correlation *r* is calculated using the following formula where:

$\bar{x}$ is the average,

S_x is the standard deviation of x,

n is the count of data pairs:

$$r = \frac{1}{n-1}\left(\frac{\sum_x \sum_y (x-\bar{x})(y-\bar{y})}{S_x S_y}\right)$$

To calculate the correlation, we need averages of columns and standard deviation of the two columns whose correlation is to be calculated. We will pre-calculate all these parameters to save time on the correlation query:

```
SELECT @av_budget := AVG(BudgetInMillions),
       @av_collection := AVG(CollectionInMillions),
       @av_time := AVG(RunningTime),
       @stdv_budget := STDDEV_SAMP(BudgetInMillions),
       @stdv_collection := STDDEV_SAMP(CollectionInMillions),
       @stdv_time := STDDEV_SAMP(RunningTime)
FROM Movies;
```

To calculate the correlation between **BudgetInMillions** and **CollectionInMillions**, we will need average values of the two variables, number of occurrences of the second variable (**CollectionInMillions**) in this case and standard deviation of both variables.

```
SELECT SUM( ( BudgetInMillions - @av_budget ) * (CollectionInMillions - @a
v_collection) ) / ((COUNT(BudgetInMillions) -1) * (@stdv_budget * @stdv_co
llection)) as Correlation
From Movies;
```

This is a direct translation of the formula shown above. To make the results readable we can encapsulate the above formula in **ROUND()** function and only show 2 digits after the decimal. Now we will calculate the pairwise correlation and display the results as a table using the **UNION** clause.

```
SELECT 'BudgetInMillions' AS Row, 'BudgetInMillions' AS Col,
        ROUND(SUM( ( BudgetInMillions - @av_budget ) * (BudgetInMillions -
 @av_budget) ) / ((COUNT(BudgetInMillions) -1) * (@stdv_budget * @stdv_bud
get)),2) AS Correlation
FROM Movies

UNION

SELECT 'BudgetInMillions' AS Row, 'CollectionInMillions' AS Col,
        ROUND( SUM( ( BudgetInMillions - @av_budget ) * (CollectionInMilli
ons - @av_collection) ) / ((COUNT(BudgetInMillions) -1) * (@stdv_budget *
 @stdv_collection)),2) AS Correlation
FROM Movies

UNION

SELECT 'BudgetInMillions' AS Row, 'RunningTime' AS Col,
        ROUND( SUM( ( BudgetInMillions - @av_budget ) * (RunningTime - @av
_time) ) / ((COUNT(BudgetInMillions) -1) * (@stdv_budget * @stdv_time)),2)
 AS Correlation
FROM Movies

UNION

SELECT 'CollectionInMillions' AS Row, 'BudgetInMillions' AS Col,
        ROUND( SUM( ( CollectionInMillions - @av_collection ) * (BudgetInM
illions - @av_budget) ) / ((COUNT(CollectionInMillions) -1) * (@stdv_colle
```

```
ction * @stdv_budget)),2) AS Correlation
FROM Movies

UNION

SELECT 'CollectionInMillions' AS Row, 'CollectionInMillions' AS Col,
        ROUND( SUM( ( CollectionInMillions - @av_collection ) * (Collectio
nInMillions - @av_collection) ) / ((COUNT(CollectionInMillions) -1) * (@st
dv_collection * @stdv_collection)),2) AS Correlation
FROM Movies

UNION

SELECT 'CollectionInMillions' AS Row, 'RunningTime' AS Col,
        ROUND( SUM( ( CollectionInMillions - @av_collection ) * (RunningTi
me - @av_time) ) / ((COUNT(CollectionInMillions) -1) * (@stdv_collection *
 @stdv_time)),2) AS Correlation
FROM Movies

UNION

SELECT 'RunningTime' AS Row, 'BudgetInMillions' AS Col,
        ROUND( SUM( ( RunningTime - @av_time ) * (BudgetInMillions - @av_b
udget) ) / ((COUNT(RunningTime) -1) * (@stdv_time * @stdv_budget)),2) AS C
orrelation
FROM Movies

UNION

SELECT 'RunningTime' AS Row, 'CollectionInMillions' AS Col,
        ROUND( SUM( ( RunningTime - @av_time ) * (CollectionInMillions - @
av_collection) ) / ((COUNT(RunningTime) -1) * (@stdv_time * @stdv_collecti
on)),2) AS Correlation
FROM Movies

UNION

SELECT 'RunningTime' AS Row, 'RunningTime' AS Col,
        ROUND( SUM( ( RunningTime - @av_time ) * (RunningTime - @av_time)
) / ((COUNT(RunningTime) -1) * (@stdv_time * @stdv_time)),2) AS Correlatio
n
FROM Movies;
```

It can be seen that the above query calculates the correlation of a column with

the rest of the three columns. For better readability, we can pivot the results

with respect to the column value as follows:

```
SELECT Row,
SUM(CASE WHEN Col='BudgetInMillions' THEN Correlation ELSE 0 END) AS Budge
t,
SUM(CASE WHEN Col='CollectionInMillions' THEN Correlation ELSE 0 END) AS C
ollection,
SUM(CASE WHEN Col='RunningTime' THEN Correlation ELSE0 END) AS RunningTime

FROM (
SELECT 'BudgetInMillions' AS Row, 'BudgetInMillions' AS Col,
        ROUND( SUM( ( BudgetInMillions - @av_budget ) * (BudgetInMillions
- @av_budget) ) / ((COUNT(BudgetInMillions) -1) * (@stdv_budget * @stdv_bu
dget)),2) AS Correlation
FROM Movies

UNION

SELECT 'BudgetInMillions' AS Row, 'CollectionInMillions' AS Col,
        ROUND( SUM( ( BudgetInMillions - @av_budget ) * (CollectionInMilli
ons - @av_collection) ) / ((COUNT(BudgetInMillions) -1) * (@stdv_budget *
 @stdv_collection)),2) AS Correlation
FROM Movies

UNION

SELECT 'BudgetInMillions' AS Row, 'RunningTime' AS Col,
        ROUND( SUM( ( BudgetInMillions - @av_budget ) * (RunningTime - @av
_time) ) / ((COUNT(BudgetInMillions) -1) * (@stdv_budget * @stdv_time)),2)
 AS Correlation
FROM Movies

UNION

SELECT 'CollectionInMillions' AS Row, 'BudgetInMillions' AS Col,
        ROUND( SUM( ( CollectionInMillions - @av_collection ) * (BudgetInM
illions - @av_budget) ) / ((COUNT(CollectionInMillions) -1) * (@stdv_colle
ction * @stdv_budget)),2) AS Correlation
FROM Movies

UNION

SELECT 'CollectionInMillions' AS Row, 'CollectionInMillions' AS Col,
        ROUND( SUM( ( CollectionInMillions - @av_collection ) * (Collectio
```

```
nInMillions - @av_collection) ) / ((COUNT(CollectionInMillions) -1) * (@st
dv_collection * @stdv_collection)),2) AS Correlation
FROM Movies

UNION

SELECT 'CollectionInMillions' AS Row, 'RunningTime' AS Col,
        ROUND( SUM( ( CollectionInMillions - @av_collection ) * (RunningTi
me - @av_time) ) / ((COUNT(CollectionInMillions) -1) * (@stdv_collection *
 @stdv_time)),2) AS Correlation
FROM Movies

UNION

SELECT 'RunningTime' AS Row, 'BudgetInMillions' AS Col,
        ROUND( SUM( ( RunningTime - @av_time ) * (BudgetInMillions - @av_b
udget) ) / ((COUNT(RunningTime) -1) * (@stdv_time * @stdv_budget)),2) AS C
orrelation
FROM Movies

UNION

SELECT 'RunningTime' AS Row, 'CollectionInMillions' AS Col,
        ROUND( SUM( ( RunningTime - @av_time ) * (CollectionInMillions - @
av_collection) ) / ((COUNT(RunningTime) -1) * (@stdv_time * @stdv_collecti
on)),2) AS Correlation
FROM Movies

UNION

SELECT 'RunningTime' AS Row, 'RunningTime' AS Col,
        ROUND( SUM( ( RunningTime - @av_time ) * (RunningTime - @av_time)
) / ((COUNT(RunningTime) -1) * (@stdv_time * @stdv_time)),2) AS Correlatio
n
FROM Movies
) T
GROUP BY Row
ORDER BY Row;
```

This table shows that budget and collection have a strong correlation which means that high budget movies have a greater return. However, budget and collection both have a weak correlation with running time.

Question # 5

Find the market share of top 3 distributors and aggregate the remaining distributors in a single row.

To answer this question, we need to find the total collection of movies by each distributor and select the top 3 rows from the answer.

```
SELECT Distributor, SUM(CollectionInMillions)
FROM Movies
GROUP BY Distributor
ORDER BY 2 DESC
LIMIT 3;
```

This query returns the top three distributors according to market share. We can plot the above data as a pie chart:

But this graph does not give a complete picture as it is missing the share of other distributors. To get the whole picture, we need to aggregate the amounts of all other distributors.

This can be achieved by selecting the top three distributors and then **UNION** the results with distributors not present in the top three. **CTE** (available in MySQL 8.0) provides an easy way to solve this problem, but in the absence of this feature we can create a temporary table that can be referred in the subsequent query.

```
CREATE TEMPORARY TABLE T1(
                      SELECT Distributor, SUM(CollectionInMillions)
                      FROM Movies
                      GROUP BY Distributor
                      ORDER BY 2 DESC
                      LIMIT 3);
```

But we cannot use this temporary table twice in a query like this:

```
SELECT * FROM T1

UNION

SELECT 'All other' as Distributor, SUM(CollectionInMillions)
FROM Movies
WHERE Distributor NOT IN (SELECT Distributor
                          FROM T1);
```

The workaround is to duplicate the temporary table and then use two separate tables in the query.

```
CREATE TEMPORARY TABLE T2
SELECT * FROM T1;

SELECT * FROM T1

UNION

SELECT 'All Others' as Distributor,
       SUM(CollectionInMillions)
FROM Movies
WHERE Distributor NOT IN (SELECT Distributor
                          FROM T2);
```

Now we have four rows and this gives a holistic view of market share of distributors. The new pie chart along with the previous one is shown to show the difference in market share: