



IIT Madras

ONLINE DEGREE

Computational Thinking
Tutorial 4.2
Nested Iterations
Naive Approach and Binning Approach

Hello, CT students you must have seen the lecture by the professors on nested iterations where they use the naive approach and the binning approaches. So, there they were trying to find out a common birth date in this course data set. In this tutorial we will look at a very similar task where we try to find score cards with the same mathematics score from the same place.

(Refer Slide Time: 0:40)

Card	Student	Place	Mathematics	Gender	D.O.B	Physics	Chem	Total
0	Bhuvanesh	Erode	68	M	7 Nov	64	78	44352
1	Harish	Salem	62	M	3 Jun	45	91	44183
2	Shashank	Chennai	57	M	4 Jan	54	77	44022
3	Rida	Chennai	42	F	5 May	53	78	44129
4	Ritika	Madurai	87	F	17 Nov	64	89	44392
5	Akshaya	Chennai	71	F	8 Feb	92	84	44116
6	Sameer	Ambur	81	M	23 Mar	82	87	44163
7	Aditya	Vellore	84	M	15 Mar	92	76	44157
8	Surya	Bengaluru	74	M	28 Feb	64	51	44078
9	Clarence	Bengaluru	63	M	6 Dec	88	73	44395
10	Kavya	Chennai	64	F	12 Jan	72	68	44046
11	Rahul	Bengaluru	97	M	30 Apr	92	92	44232
12	Srindhi	Chennai	52	F	14 Jan	64	71	44031
13	Gopi	Madurai	65	M	6 May	73	89	44184
14	Sophia	Trichy	89	F	23 July	62	93	44279
15	Goutami	Theni	76	F	22 Sep	58	90	44320
16	Tauseef	Trichy	87	M	30 Dec	86	43	44411
17	Arshad	Chennai	62	M	14 Dec	81	67	44389
18	Abirami	Erode	72	F	9 Oct	92	97	44374
19	Vetrivel	Trichy	56	M	30 Aug	78	62	44269
20	Kalyan	Vellore	93	M	17 Sep	68	91	44343

So, this is the data set as you know, since we only need these two fields in particular, let us look at a more focused version of this data set along with the pseudocode.

(Refer Slide Time: 0:52)

Count = 0

```
Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            / Count = Count + 1
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}
```

Number of Comparisons
so far = 29

Card	Student	Place	Mathematics
IIT Madras ONLINE DEGREE			
1			
Table 2			
2	Card	Student	Place
3			
4			
5			
6	0	Bhuvanesh	Erode
7			
8			
9			
10			
11	Table 3		
12	Card	Student	Place
13	1	Harish	Salem
14	2	Shashank	Chennai
15	3	Rida	Chennai
16	4	Ritika	Madurai
17	5	Akshaya	Chennai
18	6	Sameer	Ambur
19	7	Aditya	Vellore
20	8	Surya	Bengaluru
21	9	Clarence	Bengaluru
22	10	Kavya	Chennai

Count = 0

```
Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            / Count = Count + 1
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}
```

Card	Student	Place	Mathematics
IIT Madras ONLINE DEGREE			
1			
2	Card	Student	Place
28	25	Geeta	Chennai
29	26	JK	74 M
30	27	Jagan	Madurai
31	28	Nisha	74 F
32	29	Naveen	Vellore
33			
34	Table 2		
35	Card	Student	Place
36			
37			
38			
39			
40	Table 3		
41	Card	Student	Place
42			
43			
44			
45			
46			
47			

Count = 0

```
Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            / Count = Count + 1
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}
```

Card	Student	Place	Mathematics	
3	0 Bhuvanesh	Erode	68	M
4	1 Harish	Salem	62	M
5	2 Shashank	Chennai	57	M
6	3 Rida	Chennai	42	F
7	4 Ritika	Madurai	87	F
8	5 Akshaya	Chennai	71	F
9	6 Sameer	Ambur	81	M
10	7 Aditya	Vellore	84	M
11	8 Surya	Bengaluru	74	M
12	9 Clarence	Bengaluru	63	M
13	10 Kavya	Chennai	64	F
14	11 Rahul	Bengaluru	97	M
15	12 Srini	Chennai	52	F
16	13 Gopi	Madurai	65	M
17	14 Sophia	Trichy	89	F
18	15 Goutami	Theni	76	F
19	16 Tauseef	Trichy	87	M
20	17 Arshad	Chennai	62	M
21	18 Abirami	Erode	72	F
22	19 Vetrivel	Trichy	56	M

So, here this is the pseudocode and we are looking at the scorecard data set here, we now begin with initializing the count variable to 0 and there is this table 1 which is here and there is also mention of table 2 and table 3, which are placed below table 1. Now, let us begin count has been initialized to 0, while table 1 has more rows.

So, table 1 has rows now, read the first row X in table 1, so this would be the first row X in table 1 and move X to table 2, so we take this and we go off to table 2. After this is done while table 1 has more row, so are there still more rows in table 1? Yes. Read the first row Y of table 1, so this is the first row Y of table 1 and if X dot place is equal to Y dot place, so Y dot place here is Salem, X dot places erode, they are not equal, this entire AND condition is not satisfied, so we do not get inside this if block.

After that what we do? We move Y to table 3, this is our Y and we are moving it off to table 3 and now we go back to this part while table 1 has more rows and again we do the same thing here the next row is this Chennai is not the same as erode, so we move this off to table 3 and we keep doing this in this way again a Chennai not erode, so move it off the table 3.

Now, Madurai, so moving it down, now another Chennai, so moving it down, now Ambur, so move it down, now Vellore move it down, Bengaluru, so move it down, again Bengaluru, so move it down, Chennai, Bengaluru, Chennai, Madurai, Trichy, Theni, Trichy again, Chennai and now we have a situation where X dot place and Y dot place are the same, this is an Erode card.

Then we look at the second part of the AND statement, which is X dot mathematics and Y dot mathematics are they equal? It is not mathematics is 68, Y dot mathematics is 72 they are not equal, so we do not do anything again we go on to the next line of code which is to move this card to table 3.

Now, Trichy, Vellore, Bengaluru, Nagercoil, Bengaluru again, Madurai again, Chennai, Chennai, Madurai, Madurai and Vellore. So, now table 1 is empty, so this condition is not satisfied we are now out of the while loop. Once we are out of this while loop, we now go to the next line of code, which is move all rows from table 3 to table 1.

(Refer Slide Time: 6:26)

Count = 0			
Count = 0			
while (Table 1 has more rows) {			
Read the first row X in Table 1			
Move X to Table 2			
while (Table 1 has more rows) {			
Read the first row Y in Table 1			
if (X.Place == Y.Place			
and X.Mathematics == Y.Mathematics)			
{ Count = Count + 1}			
Move Y to Table 3			
}			
Move all rows from Table 3 to Table 1			
}			

Count = 0			
Count = 0			
while (Table 1 has more rows) {			
Read the first row X in Table 1			
Move X to Table 2			
while (Table 1 has more rows) {			
Read the first row Y in Table 1			
if (X.Place == Y.Place			
and X.Mathematics == Y.Mathematics)			
{ Count = Count + 1}			
Move Y to Table 3			
}			
Move all rows from Table 3 to Table 1			
}			

Count = 0			
Count = 0			
while (Table 1 has more rows) {			
Read the first row X in Table 1			
Move X to Table 2			
while (Table 1 has more rows) {			
Read the first row Y in Table 1			
if (X.Place == Y.Place			
and X.Mathematics == Y.Mathematics)			
{ Count = Count + 1}			
Move Y to Table 3			
}			
Move all rows from Table 3 to Table 1			
}			

Count = 0			
Count = 0			
while (Table 1 has more rows) {			
Read the first row X in Table 1			
Move X to Table 2			
while (Table 1 has more rows) {			
Read the first row Y in Table 1			
if (X.Place == Y.Place			
and X.Mathematics == Y.Mathematics)			
{ Count = Count + 1}			
Move Y to Table 3			
}			
Move all rows from Table 3 to Table 1			
}			

Table 1			
Card	Student	Place	Mathematics
26	24 Siddharth	Madurai	44 M
27	25 Geeta	Chennai	87 F
28	26 JK	Chennai	74 M
29	27 Jagan	Madurai	81 M
30	28 Nisha	Madurai	74 F
31	29 Naveen	Vellore	72 M
32			

Table 2			
Card	Student	Place	Maths
35	0 Bhuvanesh	Erode	68 M
36			
37			
38			

Table 3			
Card	Student	Place	Maths
41			
42			
43			
44			
45			

Count = 0			
Count = 0			
while (Table 1 has more rows) {			
Read the first row X in Table 1			
Move X to Table 2			
while (Table 1 has more rows) {			
Read the first row Y in Table 1			
if (X.Place == Y.Place			
and X.Mathematics == Y.Mathematics)			
{ Count = Count + 1}			
Move Y to Table 3			
}			
Move all rows from Table 3 to Table 1			
}			

```

Count = 0

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

Card	Student	Place	Mathematics
IIT Madras TABLE OF CONTENTS			
13	1 Harish	Salem	62 M
14	2 Shashank	Chennai	57 M
15	3 Rida	Chennai	42 F
16	4 Ritika	Madurai	87 F
17	5 Akshaya	Chennai	71 F
18	6 Sameer	Ambur	81 M
19	7 Aditya	Vellore	84 M
20	8 Surya	Bengaluru	74 M
21	9 Clarence	Bengaluru	63 M
22	10 Kavya	Chennai	64 F
23	11 Rahul	Bengaluru	97 M
24	12 Srinidhi	Chennai	52 F
25	13 Gopi	Madurai	65 M
26	14 Sophia	Trichy	89 F
27	15 Goutami	Theni	76 F
28	16 Tauseef	Trichy	87 M
29	17 Arshad	Chennai	62 M
30	18 Abirami	Erode	72 F

So, we empty table 3 and move it all to table 1, so we are now they are all back in table 1 and table 3 is empty.

(Refer Slide Time: 6:49)

```

Count = 0

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

Card	Student	Place	Mathematics
IIT Madras TABLE OF CONTENTS			
26	JK	Chennai	74 M
27	Jagan	Madurai	81 M
28	Nisha	Madurai	74 F
29	Naveen	Vellore	72 M
31			
32	Card	Student	Place
33	Table 2	Maths	
34	0 Bhuvanesh	Erode	68 M
35	1 Harish	Salem	62 M
36			
37			
38			
39			
40	Card	Student	Place
41	Table 3	Maths	
42			
43			
44			
45			
46			

Count = 0

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            / Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

Card	Student	Place	Mathematics	
3	1 Harish	Salem	62	M
4	2 Shashank	Chennai	57	M
5	3 Rida	Chennai	42	F
6	4 Ritika	Madurai	87	F
7	5 Akshaya	Chennai	71	F
8	6 Sameer	Ambur	81	M
9	7 Aditya	Vellore	84	M
10	8 Surya	Bengaluru	74	M
11	9 Clarence	Bengaluru	63	M
12	10 Kavya	Chennai	64	F
13	11 Rahul	Bengaluru	97	M
14	12 Srinidhi	Chennai	52	F
15	13 Gopi	Madurai	65	M
16	14 Sophia	Trichy	89	F
17	15 Goutami	Theni	76	F
18	16 Tauseef	Trichy	87	M
19	17 Arshad	Chennai	62	M
20	18 Abirami	Erode	72	F
21	19 Vetrivel	Trichy	56	M
22	20 Kalyan	Vellore	93	M

Count = 0

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            / Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

Number of Comparisons
so far = 29 + 28 = 57

Card	Student	Place	Maths		
3					
4					
5					
6	0 Bhuvanesh	Erode	68	M	
7	1 Harish	Salem	62	M	
8					
9					
10					
11					
12					
13	Card	Student	Place	Maths	
14	2 Shashank	Chennai	57	M	
15	3 Rida	Chennai	42	F	
16	4 Ritika	Madurai	87	F	
17	5 Akshaya	Chennai	71	F	
18	6 Sameer	Ambur	81	M	
19	7 Aditya	Vellore	84	M	
20	8 Surya	Bengaluru	74	M	
21	9 Clarence	Bengaluru	63	M	
22	10 Kavya	Chennai	64	F	

And after that while table 1 has more rows, so table 1 again has more rows, now again read the first row X in table 1 which is this one and move it to table 2. So, we have moved it to table 2. Now, X is this row, X dot place the Salem, so we again do the same procedure of taking each row looking if it is Salem or not and as you can see none this is Salem, so one by one we drop off these rows into table 3. Now table 1 is empty again, so we move all these rows back to table 1.

(Refer Slide Time: 8:12)

Count = 0

```
Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            / Count = Count + 1}
        Move Y to Table 3
}
```

Move all rows from Table 3 to Table 1

Card	Student	Place	Mathematics
17	17 Arshad	Chennai	62 M
18	18 Abirami	Erode	72 F
19	19 Vetrivel	Trichy	56 M
20	20 Kalyan	Vellore	93 M
21	21 Monika	Bengaluru	78 F
22	22 Priya	Nagercoil	62 F
23	23 Deepika	Bengaluru	97 F
24	24 Siddharth	Madurai	44 M
25	25 Geeta	Chennai	87 F
26	26 JK	Chennai	74 M
27	27 Jagan	Madurai	81 M
28	28 Nisha	Madurai	74 F
29	29 Naveen	Vellore	72 M
30			
31	Card	Student	Place
32	Maths		
33	0 Bhuvanesh	Erode	68 M
34	1 Harish	Salem	62 M
35	2 Shashank	Chennai	57 M
36			

Count = 0

```
Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            / Count = Count + 1}
        Move Y to Table 3
}
```

Move all rows from Table 3 to Table 1

Card	Student	Place	Mathematics
3	2 Shashank	Chennai	57 M
4	3 Rida	Chennai	42 F
5	4 Ritika	Madurai	87 F
6	5 Akshaya	Chennai	71 F
7	6 Sameer	Ambur	81 M
8	7 Aditya	Vellore	84 M
9	8 Surya	Bengaluru	74 M
10	9 Clarence	Bengaluru	63 M
11	10 Kavya	Chennai	64 F
12	11 Rahul	Bengaluru	97 M
13	12 Srinidhi	Chennai	52 F
14	13 Gopi	Madurai	65 M
15	14 Sophia	Trichy	89 F
16	15 Goutami	Theni	76 F
17	16 Tauseef	Trichy	87 M
18	17 Arshad	Chennai	62 M
19	18 Abirami	Erode	72 F
20	19 Vetrivel	Trichy	56 M
21	20 Kalyan	Vellore	93 M
22	21 Monika	Bengaluru	78 F

Count = 0

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

**Number of Comparisons
so far = 57 + 27 = 84**

1	Card	Student	Place	Mathematics	Gen
15	3	Rida	Chennai	42	F
16	4	Ritika	Madurai	87	F
17	5	Akshaya	Chennai	71	F
18	6	Sameer	Ambur	81	M
19	7	Aditya	Vellore	84	M
20	8	Surya	Bengaluru	74	M
21	9	Clarence	Bengaluru	63	M
22	10	Kavya	Chennai	64	F
23	11	Rahul	Bengaluru	97	M
24	12	Srinidhi	Chennai	52	F
25	13	Gopi	Madurai	65	M
26	14	Sophia	Trichy	89	F
27	15	Goutami	Theni	76	F
28	16	Tauseef	Trichy	87	M
29	17	Arshad	Chennai	62	M
30	18	Abirami	Erode	72	F
31	19	Vetrivel	Trichy	56	M

Now, again the first row X in this table is this where we have Chennai as the place, so this is our X dot place and then we start looking here this is Chennai, so we now verify if the maths score is same. This is 57, this is 42, so they are not same so we move this row down. Now, the next one is Madurai and now again it is a Chennai and the mathematics score is 71 which is not equal to 57, so this also goes down.

And here we have a Chennai again and the mathematics score is 64 which is not 57, so this goes down too. This is a Chennai again mathematics score is only 52, so this goes away, now another Chennai and mathematics score is 62 not equal to 57 this goes down., here we have a Chennai again with mathematics score 87 not equal to 57. And again Chennai, but 74, now table 1 is empty, so we move all the rows from table 3 to table 1.

(Refer Slide Time: 10:23)



Count = 0

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

**Number of Comparisons
so far = 57 + 27 = 84**

Card	Student	Place	Mathematics	Gen
3	Rida	Chennai	42	F
4	Ritika	Madurai	87	F
5	Akshaya	Chennai	71	F
6	Sameer	Ambur	81	M
7	Aditya	Vellore	84	M
8	Surya	Bengaluru	74	M
9	Clarence	Bengaluru	63	M
10	Kavya	Chennai	64	F
11	Rahul	Bengaluru	97	M
12	Srinidhi	Chennai	52	F
13	Gopi	Madurai	65	M
14	Sophia	Trichy	89	F
15	Goutami	Theni	76	F
16	Tauseef	Trichy	87	M
17	Arshad	Chennai	62	M
18	Abirami	Erode	72	F
19	Vetrivel	Trichy	56	M

Count = 0

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

**Number of Comparisons
so far = 84 + 26 = 110**

Card	Student	Place	Maths	Gen
16	Ritika	Madurai	87	F
17	Akshaya	Chennai	71	F
18	Sameer	Ambur	81	M
19	Aditya	Vellore	84	M
20	Surya	Bengaluru	74	M
21	Clarence	Bengaluru	63	M
22	Kavya	Chennai	64	F
23	Rahul	Bengaluru	97	M
24	Srinidhi	Chennai	52	F
25	Gopi	Madurai	65	M
26	Sophia	Trichy	89	F
27	Goutami	Theni	76	F
28	Tauseef	Trichy	87	M

And now, we have this is our row X and we bring it down to table 2, here the place is Chennai and maths score is 42, so let us begin again. Now, the place is Chennai, but maths score is not 42, now here place is Chennai, but match score is not 42, here the place is Chennai but the maths score is not 42, Chennai again maths score is not 42. Now, this is Chennai, but my score is not 42, again Chennai, but not 42. Now, table 1 is empty, we come out of this particular while block and remove all these rows again back to table 1.

(Refer Slide Time: 11:59)



Count = 0

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

Card	Student	Place	Mathematics	Gen
3	Ritika	Madurai	87	F
4	Akshaya	Chennai	71	F
5	Sameer	Ambur	81	M
6	Aditya	Vellore	84	M
7	Surya	Bengaluru	74	M
8	Clarence	Bengaluru	63	M
9	Kavya	Chennai	64	F
10	Rahul	Bengaluru	97	M
11	Srinidhi	Chennai	52	F
12	Gopi	Madurai	65	M
13	Sophia	Trichy	89	F
14	Goutami	Theni	76	F
15	Tauseef	Trichy	87	M
16	Arshad	Chennai	62	M
17	Abirami	Erode	72	F
18	Vetrivel	Trichy	56	M
19	Kalyan	Vellore	93	M
20				

Count = 0

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

Card	Student	Place	Maths	Gen	
6	Bhuvanesh	Erode	68	M	
7	Harish	Salem	62	M	
8	Shashank	Chennai	57	M	
9	Rida	Chennai	42	F	
10	Ritika	Madurai	87	F	
11					
12					
13					
14					
15					
16	Card	Student	Place	Maths	Gen
17	5	Akshaya	Chennai	71	F
18	6	Sameer	Ambur	81	M
19	7	Aditya	Vellore	84	M
20	8	Surya	Bengaluru	74	M
21	9	Clarence	Bengaluru	63	M
22	10	Kavya	Chennai	64	F
23	11	Rahul	Bengaluru	97	M
24	12	Srinidhi	Chennai	52	F

Number of Comparisons
so far = 110 + 25 = 135

Now, this is row X, which we move to table 2, place is Madurai maths score is 87. Going back into this while loop. Now, we have a Madurai, but maths score does not match, here is another Madurai but maths score is not 87, another Madurai, but maths score is not 87, one more Madurai but maths score does not match, table 1 is empty, so we move all the rows from table 3 to table 1.

(Refer Slide Time: 13:16)

Count = 0

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}
  
```

Number of Comparisons
so far = 110 + 25 = 135

Card	Student	Place	Mathematics	Gen
3	5 Akshaya	Chennai	71	F
4	6 Sameer	Ambur	81	M
5	7 Aditya	Vellore	84	M
6	8 Surya	Bengaluru	74	M
7	9 Clarence	Bengaluru	63	M
8	10 Kavya	Chennai	64	F
9	11 Rahul	Bengaluru	97	M
10	12 Srinidhi	Chennai	52	F
11	13 Gopi	Madurai	65	M
12	14 Sophia	Trichy	89	F
13	15 Goutami	Theni	76	F
14	16 Tauseef	Trichy	87	M
15	17 Arshad	Chennai	62	M
16	18 Abirami	Erode	72	F
17	19 Vetivel	Trichy	56	M
18	20 Kalyan	Vellore	93	M
19	21 Monika	Bengaluru	78	F
20

Count = 0

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}
  
```

Number of Comparisons
so far = 135 + 24 = 159

Card	Student	Place	Maths	Gen
4	0 Bhuvanesh	Erode	68	M
5	1 Harish	Salem	62	M
6	2 Shashank	Chennai	57	M
7	3 Rida	Chennai	42	F
8	4 Ritika	Madurai	87	F
9	5 Akshaya	Chennai	71	F
10

Card	Student	Place	Maths	Gen
17	6 Sameer	Ambur	81	M
18	7 Aditya	Vellore	84	M
19

Now, row X is this which we move to table 2, the place is Chennai the match score is 71. Here it is Chennai, but not 71, Chennai but not 71, Chennai but not 71, Chennai but not 71, Chennai but not 71, table 1 is empty now, so we move all the rows from table 3 to table 1.

(Refer Slide Time: 14:31)



Count = 0

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

Number of Comparisons
so far = $135 + 24 = 159$

1	Table 1				
2	Card	Student	Place	Mathematics	Gender
3	6	Sameer	Ambur	81	M
4	7	Aditya	Vellore	84	M
5	8	Surya	Bengaluru	74	M
6	9	Clarence	Bengaluru	63	M
7	10	Kavya	Chennai	64	F
8	11	Rahul	Bengaluru	97	M
9	12	Srinidhi	Chennai	52	F
10	13	Gopi	Madurai	65	M
11	14	Sophia	Trichy	89	F
12	15	Goutami	Theni	76	F
13	16	Tauseef	Trichy	87	M
14	17	Arshad	Chennai	62	M
15	18	Abirami	Erode	72	F
16	19	Vetrivel	Trichy	56	M
17	20	Kalyan	Vellore	93	M
18	21	Monika	Bengaluru	78	F
19	22	Priya	Nagercoil	62	F
20	23	Deepika	Bengaluru	97	F
21	24	Siddharth	Madurai	44	M
22	25	Geeta	Chennai	87	F
23	26	JK	Chennai	74	M
24	27	Jagan	Madurai	81	M
25	28	Nisha	Madurai	74	F
26	29	Naveen	Vellore	72	M

Count = 0

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

Number of Comparisons
so far = $159 + 23 = 182$

23	11	Rahul	Bengaluru	97	M
24	12	Srinidhi	Chennai	52	F
25	13	Gopi	Madurai	65	M
26	14	Sophia	Trichy	89	F
27	15	Goutami	Theni	76	F
28	16	Tauseef	Trichy	87	M
29	17	Arshad	Chennai	62	M
30	18	Abirami	Erode	72	F
31	19	Vetrivel	Trichy	56	M
32	20	Kalyan	Vellore	93	M
33	21	Monika	Bengaluru	78	F
34	22	Priya	Nagercoil	62	F
35	23	Deepika	Bengaluru	97	F
36	24	Siddharth	Madurai	44	M
37	25	Geeta	Chennai	87	F
38	26	JK	Chennai	74	M
39	27	Jagan	Madurai	81	M
40	28	Nisha	Madurai	74	F
41	29	Naveen	Vellore	72	M

Now, this is our row X which we move to table 2, the place is Ambur the maths score is 81. So, now table 1 is empty which means there is only 1 Ambur card, anyway now we move all the rows from table 3 to table 1 again.

(Refer Slide Time: 15:15)



Count = 0

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

1	Table 1				
2	Card	Student	Place	Mathematics	Gen
3	7	Aditya	Vellore	84	M
4	8	Surya	Bengaluru	74	M
5	9	Clarence	Bengaluru	63	M
6	10	Kavya	Chennai	64	F
7	11	Rahul	Bengaluru	97	M
8	12	Srinidhi	Chennai	52	F
9	13	Gopi	Madurai	65	M
10	14	Sophia	Trichy	89	F
11	15	Goutami	Theni	76	F
12	16	Tauseef	Trichy	87	M
13	17	Arshad	Chennai	62	M
14	18	Abirami	Erode	72	F
15	19	Vetrivel	Trichy	56	M
16	20	Kalyan	Vellore	93	M
17	21	Monika	Bengaluru	78	F
18	22	Priya	Nagercoil	62	F
19	23	Deepika	Bengaluru	97	F
20	24	Siddharth	Madurai	44	M
21	25	Geeta	Chennai	87	F

Count = 0

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

19	Card	Student	Place	Maths	Gen
20	8	Surya	Bengaluru	74	M
21	9	Clarence	Bengaluru	63	M
22	10	Kavya	Chennai	64	F
23	11	Rahul	Bengaluru	97	M
24	12	Srinidhi	Chennai	52	F
25	13	Gopi	Madurai	65	M
26	14	Sophia	Trichy	89	F
27	15	Goutami	Theni	76	F
28	16	Tauseef	Trichy	87	M
29	17	Arshad	Chennai	62	M
30	18	Abirami	Erode	72	F
31	19	Vetrivel	Trichy	56	M
32	20	Kalyan	Vellore	93	M
33	21	Monika	Bengaluru	78	F
34	22	Priya	Nagercoil	62	F
35	23	Deepika	Bengaluru	97	F
36	24	Siddharth	Madurai	44	M
37	25	Geeta	Chennai	87	F

Number of Comparisons
so far = 182 + 22 = 204

Now, our row X is this which we carry down to table 2, so Vellore 84, here this is a Vellore but the score is not 84, one more Vellore, but the score is not 84 and table 1 is empty. So, we move back all the table 3 goes to table 1.

(Refer Slide Time: 16:13)



Count = 0

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

1	Table 1				
2	Card	Student	Place	Mathematics	Gender
3	8	Surya	Bengaluru	74	M
4	9	Clarence	Bengaluru	63	M
5	10	Kavya	Chennai	64	F
6	11	Rahul	Bengaluru	97	M
7	12	Srinidhi	Chennai	52	F
8	13	Gopi	Madurai	65	M
9	14	Sophia	Trichy	89	F
10	15	Goutami	Theni	76	F
11	16	Tauseef	Trichy	87	M
12	17	Arshad	Chennai	62	M
13	18	Abirami	Erode	72	F
14	19	Vetrivel	Trichy	56	M
15	20	Kalyan	Vellore	93	M
16	21	Monika	Bengaluru	78	F
17	22	Priya	Nagercoil	62	F
18	23	Deepika	Bengaluru	97	F
19	24	Siddharth	Madurai	44	M
20	25	Geeta	Chennai	87	F
21	26	JK	Chennai	74	M
22	27	Jagan	Madurai	81	M
23	28	Nisha	Madurai	74	F
24	29	Naveen	Vellore	72	M

Count = 0

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

24	12	Srinidhi	Chennai	52	F
25	13	Gopi	Madurai	65	M
26	14	Sophia	Trichy	89	F
27	15	Goutami	Theni	76	F
28	16	Tauseef	Trichy	87	M
29	17	Arshad	Chennai	62	M
30	18	Abirami	Erode	72	F
31	19	Vetrivel	Trichy	56	M
32	20	Kalyan	Vellore	93	M
33	21	Monika	Bengaluru	78	F
34	22	Priya	Nagercoil	62	F
35	23	Deepika	Bengaluru	97	F
36	24	Siddharth	Madurai	44	M
37	25	Geeta	Chennai	87	F
38	26	JK	Chennai	74	M
39	27	Jagan	Madurai	81	M
40	28	Nisha	Madurai	74	F
41	29	Naveen	Vellore	72	M
42	30				

Number of Comparisons
so far = 204 + 21 = 225

Now, this is our row X taken to table 2, Bengaluru 74, this is a Bengaluru, but the score is not 74. Again Bengaluru but not 74, again Bengaluru but not 74, Bengaluru but not 74, no more rows in table 1, so we move table 3 rows back to table 1.

(Refer Slide Time: 17:19)



Count = 0

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

1	Table 1				
2	Card	Student	Place	Mathematics	Gender
3	9	Clarence	Bengaluru	63	M
4	10	Kavya	Chennai	64	F
5	11	Rahul	Bengaluru	97	M
6	12	Srinidhi	Chennai	52	F
7	13	Gopi	Madurai	65	M
8	14	Sophia	Trichy	89	F
9	15	Goutami	Theni	76	F
10	16	Tauseef	Trichy	87	M
11	17	Arshad	Chennai	62	M
12	18	Abirami	Erode	72	F
13	19	Vetivel	Trichy	56	M
14	20	Kalyan	Vellore	93	M
15	21	Monika	Bengaluru	78	F
16	22	Priya	Nagercoil	62	F
17	23	Deepika	Bengaluru	97	F
18	24	Siddharth	Madurai	44	M
19	25	Geeta	Chennai	87	F
...

Count = 0

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

9	3	Rida	Chennai	42	F
10	4	Ritika	Madurai	87	F
11	5	Akshaya	Chennai	71	F
12	6	Sameer	Ambur	81	M
13	7	Aditya	Vellore	84	M
14	8	Surya	Bengaluru	74	M
15	9	Clarence	Bengaluru	63	M
16					
17					
18					
19					
20	Table 3				
21	Card	Student	Place	Maths	Gen
22	10	Kavya	Chennai	64	F
23	11	Rahul	Bengaluru	97	M
24	12	Srinidhi	Chennai	52	F
25	13	Gopi	Madurai	65	M
26	14	Sophia	Trichy	89	F
27	15	Goutami	Theni	76	F
...

Number of Comparisons
so far = 225 + 20 = 245

Now, this is our row X which is been carried to table 2, this is Bengaluru 63, this is a Bengaluru but not 63, Bengaluru but not 63, Bengaluru but not 63, table 1 is empty, so we move these rows back.

(Refer Slide Time: 18:12)



Count = 0

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

Number of Comparisons
so far = 225 + 20 = 245

Card	Student	Place	Mathematics	Gender
10	Kavya	Chennai	64	F
11	Rahul	Bengaluru	97	M
12	Srinidhi	Chennai	52	F
13	Gopi	Madurai	65	M
14	Sophia	Trichy	89	F
15	Goutami	Theni	76	F
16	Tauseef	Trichy	87	M
17	Arshad	Chennai	62	M
18	Abirami	Erode	72	F
19	Vetrivel	Trichy	56	M
20	Kalyan	Vellore	93	M
21	Monika	Bengaluru	78	F
22	Priya	Nagercoil	62	F
23	Deepika	Bengaluru	97	F
24	Siddharth	Madurai	44	M
25	Geeta	Chennai	87	F
26	JK	Chennai	74	M

Count = 0

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

Number of Comparisons
so far = 245 + 19 = 264

24	12 Srinidhi	Chennai	52	F
25	13 Gopi	Madurai	65	M
26	14 Sophia	Trichy	89	F
27	15 Goutami	Theni	76	F
28	16 Tauseef	Trichy	87	M
29	17 Arshad	Chennai	62	M
30	18 Abirami	Erode	72	F
31	19 Vetrivel	Trichy	56	M
32	20 Kalyan	Vellore	93	M
33	21 Monika	Bengaluru	78	F
34	22 Priya	Nagercoil	62	F
35	23 Deepika	Bengaluru	97	F
36	24 Siddharth	Madurai	44	M
37	25 Geeta	Chennai	87	F
38	26 JK	Chennai	74	M
39	27 Jagan	Madurai	81	M
40	28 Nisha	Madurai	74	F
41	29 Naveen	Vellore	72	M

Now, this is our row X, let us move to table 2, this is Chennai 64, this is Chennai but not 64, this is Chennai but not 64, Chennai but not 64, Chennai but not 64, table 1 is empty, so bring all these rows back.

(Refer Slide Time: 19:03)



Count = 1

```
Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            {Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}
```

Number of Comparisons
so far = 264 + 18 = 282

14	8	Surya	Bengaluru	74	M
15	9	Clarence	Bengaluru	63	M
16	10	Kavya	Chennai	64	F
17	11	Rahul	Bengaluru	97	M
18					
19					
20					
21					
22					
23					
24	12	Srinidhi	Chennai	52	F
25	13	Gopi	Madurai	65	M
26	14	Sophia	Trichy	89	F
27	15	Goutami	Theni	76	F
28	16	Tauseef	Trichy	87	M
29	17	Arshad	Chennai	62	M
30	18	Abirami	Erode	72	F
31	19	Vetrivel	Trichy	56	M
32	20	Kalyan	Vellore	93	M
33					

Count = 1

```
Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            {Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}
```

Number of Comparisons
so far = 264 + 18 = 282

1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13	23	Deepika	Bengaluru	97	F
14	24	Siddharth	Madurai	44	M
15	25	Geeta	Chennai	87	F
16	26	JK	Chennai	74	M
17	27	Jagan	Madurai	81	M
18	28	Nisha	Madurai	74	F
19	29	Naveen	Vellore	72	M
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					
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76					
77					
78					
79					
80					
81					
82					
83					
84					
85					
86					
87					
88					
89					
90					
91					
92					
93					
94					
95					
96					
97					
98					
99					
100					

Count = 1

```
Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            {Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}
```

Count = 0

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

Number of Comparisons
so far = 245 + 19 = 264

	Card	Student	Place	Mathematics	Gen
1	11	Rahul	Bengaluru	97	M
2	12	Srinidhi	Chennai	52	F
3	13	Gopi	Madurai	65	M
4	14	Sophia	Trichy	89	F
5	15	Goutami	Theni	76	F
6	16	Tauseef	Trichy	87	M
7	17	Arshad	Chennai	62	M
8	18	Abirami	Erode	72	F
9	19	Vetrivel	Trichy	56	M
10	20	Kalyan	Vellore	93	M
11	21	Monika	Bengaluru	78	F
12	22	Priya	Nagercoil	62	F
13	23	Deepika	Bengaluru	97	F
14	24	Siddharth	Madurai	44	M
15	25	Geeta	Chennai	87	F
16	26	JK	Chennai	74	M
17	27	Jagan	Madurai	81	M
18	28				
19	29				
20	30				
21	31				
22	32				
23	33				
24	34				
25	35				
26	36				
27	37				
28	38				
29	39				
30	40				
31	41				
32	42				
33	43				

This is our row X now, we move it to table 2, so Bengaluru 97, this is Bengaluru but not 97. Now, this is Bengaluru and the maths score is 97, which is identical to our card X here. So, this is common and we finally enter this portion of the code where we increment count to 1. So, we found one pair of cards with same place and same mathematics score. And then we get back to the same business of moving this down, table 1 is now empty, so we carry these rows back to table 1.

(Refer Slide Time: 20:23)

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

Number of Comparisons
so far = 282 + 17 = 299

25	13	Gopi	Madurai	65	M
26	14	Sophia	Trichy	89	F
27	15	Goutami	Theni	76	F
28	16	Tauseef	Trichy	87	M
29	17	Arshad	Chennai	62	M
30	18	Abirami	Erode	72	F
31	19	Vetrivel	Trichy	56	M
32	20	Kalyan	Vellore	93	M
33	21	Monika	Bengaluru	78	F
34	22	Priya	Nagercoil	62	F
35	23	Deepika	Bengaluru	97	F
36	24	Siddharth	Madurai	44	M
37	25	Geeta	Chennai	87	F
38	26	JK	Chennai	74	M
39	27	Jagan	Madurai	81	M
40	28	Nisha	Madurai	74	F
41	29	Naveen	Vellore	72	M
42					
43					

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}
  
```

		Table 1			
	Card	Student	Place	Mathematics	Gen
3	12	Srinidhi	Chennai	52	F
4	13	Gopi	Madurai	65	M
5	14	Sophia	Trichy	89	F
6	15	Goutami	Theni	76	F
7	16	Tauseef	Trichy	87	M
8	17	Arshad	Chennai	62	M
9	18	Abirami	Erode	72	F
10	19	Vetrivel	Trichy	56	M
11	20	Kalyan	Vellore	93	M
12	21	Monika	Bengaluru	78	F
13	22	Priya	Nagercoil	62	F
14	23	Deepika	Bengaluru	97	F
15	24	Siddharth	Madurai	44	M
16	25	Geeta	Chennai	87	F
17	26	JK	Chennai	74	M
18	27	Jagan	Madurai	81	M
19	28	Nisha	Madurai	74	F
20	29	**	**	**	**

This is our row X now, which is being carried to table 2, this is Chennai 52. This is Chennai but not 52, again Chennai not 52, Chennai but not 52, table 1 is now empty, so we go to table 3 pick up all these rows and again take them to table 1.

(Refer Slide Time: 21:08)

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}
  
```

		Table 3			
	Card	Student	Place	Maths	Gen
24	14	Sophia	Trichy	89	F
25	15	Goutami	Theni	76	F
26	16	Tauseef	Trichy	87	M
27	17	Arshad	Chennai	62	M
28	18	Abirami	Erode	72	F
29	19	Vetrivel	Trichy	56	M
30	20	Kalyan	Vellore	93	M
31	21	Monika	Bengaluru	78	F
32	22	Priya	Nagercoil	62	F
33	23	Deepika	Bengaluru	97	F
34	24	Siddharth	Madurai	44	M
35	25	Geeta	Chennai	87	F
36	26	JK	Chennai	74	M
37	27	Jagan	Madurai	81	M
38	28	Nisha	Madurai	74	F
39	29	Naveen	Vellore	72	M
40	**	**	**	**	**
41	**	**	**	**	**
42	**	**	**	**	**

Number of Comparisons
so far = 299 + 16 = 315

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
        and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

1	Table 1				
2	Card	Student	Place	Mathematics	Gen
3	13	Gopi	Madurai	65	M
4	14	Sophia	Trichy	89	F
5	15	Goutami	Theni	76	F
6	16	Tauseef	Trichy	87	M
7	17	Arshad	Chennai	62	M
8	18	Abirami	Erode	72	F
9	19	Vetrivel	Trichy	56	M
10	20	Kalyan	Vellore	93	M
11	21	Monika	Bengaluru	78	F
12	22	Priya	Nagercoil	62	F
13	23	Deepika	Bengaluru	97	F
14	24	Siddharth	Madurai	44	M
15	25	Geeta	Chennai	87	F
16	26	JK	Chennai	74	M
17	27	Jagan	Madurai	81	M
18	28	Nisha	Madurai	74	F
19	29	Naveen	Vellore	72	M
...					

This is our row X now, we carry it to table 2, drop it here in table 2, it is Madurai 65, another Madurai but not 65, Madurai but not 65, Madurai but not 65, so table 1 is now empty, so again we carry table 3 rows and drop them over there.

(Refer Slide Time: 21:51)

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
        and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

Number of Comparisons
so far = 315 + 15 = 330

24	Table 3				
25	Card	Student	Place	Maths	Gen
26	15	Goutami	Theni	76	F
27	16	Tauseef	Trichy	87	M
28	17	Arshad	Chennai	62	M
29	18	Abirami	Erode	72	F
30	19	Vetrivel	Trichy	56	M
31	20	Kalyan	Vellore	93	M
32	21	Monika	Bengaluru	78	F
33	22	Priya	Nagercoil	62	F
34	23	Deepika	Bengaluru	97	F
35	24	Siddharth	Madurai	44	M
36	25	Geeta	Chennai	87	F
37	26	JK	Chennai	74	M
38	27	Jagan	Madurai	81	M
39	28	Nisha	Madurai	74	F
40	29	Naveen	Vellore	72	M
41					
42					
...					

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

Number of Comparisons
so far = $299 + 16 = 315$

	Card	Student	Place	Mathematics	Gen
1					
2					
3	14	Sophia	Trichy	89	F
4	15	Goutami	Theni	76	F
5	16	Tauseef	Trichy	87	M
6	17	Arshad	Chennai	62	M
7	18	Abirami	Erode	72	F
8	19	Vetrivel	Trichy	56	M
9	20	Kalyan	Vellore	93	M
10	21	Monika	Bengaluru	78	F
11	22	Priya	Nagercoil	62	F
12	23	Deepika	Bengaluru	97	F
13	24	Siddharth	Madurai	44	M
14	25	Geeta	Chennai	87	F
15	26	JK	Chennai	74	M
16	27	Jagan	Madurai	81	M
17	28	Nisha	Madurai	74	F
18	29	Naveen	Vellore	72	M
19					
20					
21					
22					
23					
24					
25					
26					
27					
28	16	Tauseef	Trichy	87	M
29	17	Arshad	Chennai	62	M
30	18	Abirami	Erode	72	F
31	19	Vetrivel	Trichy	56	M
32	20	Kalyan	Vellore	93	M
33	21	Monika	Bengaluru	78	F
34	22	Priya	Nagercoil	62	F
35	23	Deepika	Bengaluru	97	F
36	24	Siddharth	Madurai	44	M
37	25	Geeta	Chennai	87	F
38	26	JK	Chennai	74	M
39	27	Jagan	Madurai	81	M
40	28	Nisha	Madurai	74	F
41	29	Naveen	Vellore	72	M
42					
43					
44					
45					
46					
47					
48					
49					
50					

Now, this is our row X which is moved to table 2, it is Trichy 89. Now, this is Trichy 87, it is not 89, it is Trichy not 89, table 1 is empty so we again pick up these rows from table 3 and carry them up.

(Refer Slide Time: 22:40)

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

Number of Comparisons
so far = $330 + 14 = 344$

	Card	Student	Place	Maths	Gen
23					
24					
25					
26					
27	16	Tauseef	Trichy	87	M
28	17	Arshad	Chennai	62	M
29	18	Abirami	Erode	72	F
30	19	Vetrivel	Trichy	56	M
31	20	Kalyan	Vellore	93	M
32	21	Monika	Bengaluru	78	F
33	22	Priya	Nagercoil	62	F
34	23	Deepika	Bengaluru	97	F
35	24	Siddharth	Madurai	44	M
36	25	Geeta	Chennai	87	F
37	26	JK	Chennai	74	M
38	27	Jagan	Madurai	81	M
39	28	Nisha	Madurai	74	F
40	29	Naveen	Vellore	72	M
41					
42					
43					
44					
45					
46					
47					
48					
49					
50					

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
        and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}
  
```

1	Card	Student	Place	Mathematics	Gen
2					
3	15	Goutami	Theni	76	F
4	16	Tauseef	Trichy	87	M
5	17	Arshad	Chennai	62	M
6	18	Abirami	Erode	72	F
7	19	Vetrivel	Trichy	56	M
8	20	Kalyan	Vellore	93	M
9	21	Monika	Bengaluru	78	F
10	22	Priya	Nagercoil	62	F
11	23	Deepika	Bengaluru	97	F
12	24	Siddharth	Madurai	44	M
13	25	Geeta	Chennai	87	F
14	26	JK	Chennai	74	M
15	27	Jagan	Madurai	81	M
16	28	Nisha	Madurai	74	F
17	29	Naveen	Vellore	72	M
18					
19					

Table 1

1	Card	Student	Place	Maths	Gen
2					
3	16	Tauseef	Trichy	87	M
4	17	Arshad	Chennai	62	M
5	18	Abirami	Erode	72	F
6	19	Vetrivel	Trichy	56	M
7	20	Kalyan	Vellore	93	M
8	21	Monika	Bengaluru	78	F
9	22	Priya	Nagercoil	62	F
10	23	Deepika	Bengaluru	97	F
11	24	Siddharth	Madurai	44	M
12	25	Geeta	Chennai	87	F
13	26	JK	Chennai	74	M
14	27	Jagan	Madurai	81	M
15	28	Nisha	Madurai	74	F
16	29	Naveen	Vellore	72	M
17					
18					
19					

Table 2

Now, this is our row X we drop it in table 2 this is Theni 76, table 1 is empty again, there was only 1 Theni card then, not Theni cards otherwise, now we take these rows and go drop them here.

(Refer Slide Time: 23:12)

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
        and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}
  
```

1	Card	Student	Place	Mathematics	Gen
2					
3	16	Tauseef	Trichy	87	M
4	17	Arshad	Chennai	62	M
5	18	Abirami	Erode	72	F
6	19	Vetrivel	Trichy	56	M
7	20	Kalyan	Vellore	93	M
8	21	Monika	Bengaluru	78	F
9	22	Priya	Nagercoil	62	F
10	23	Deepika	Bengaluru	97	F
11	24	Siddharth	Madurai	44	M
12	25	Geeta	Chennai	87	F
13	26	JK	Chennai	74	M
14	27	Jagan	Madurai	81	M
15	28	Nisha	Madurai	74	F
16	29	Naveen	Vellore	72	M
17					
18					
19					

Table 1

1	Card	Student	Place	Maths	Gen
2					
3	16	Tauseef	Trichy	87	M
4	17	Arshad	Chennai	62	M
5	18	Abirami	Erode	72	F
6	19	Vetrivel	Trichy	56	M
7	20	Kalyan	Vellore	93	M
8	21	Monika	Bengaluru	78	F
9	22	Priya	Nagercoil	62	F
10	23	Deepika	Bengaluru	97	F
11	24	Siddharth	Madurai	44	M
12	25	Geeta	Chennai	87	F
13	26	JK	Chennai	74	M
14	27	Jagan	Madurai	81	M
15	28	Nisha	Madurai	74	F
16	29	Naveen	Vellore	72	M
17					
18					
19					

Table 2

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}
  
```

Card	Student	Place	Maths	Gen
29	17 Arshad	Chennai	62	M
30	18 Abirami	Erode	72	F
31	19 Vetrivel	Trichy	56	M
32	20 Kalyan	Vellore	93	M
33	21 Monika	Bengaluru	78	F
34	22 Priya	Nagercoil	62	F
35	23 Deepika	Bengaluru	97	F
36	24 Siddharth	Madurai	44	M
37	25 Geeta	Chennai	87	F
38	26 JK	Chennai	74	M
39	27 Jagan	Madurai	81	M
40	28 Nisha	Madurai	74	F
41	29 Naveen	Vellore	72	M

Add 1000 more rows at bottom.

Number of Comparisons
so far = $344 + 13 = 357$

This is our row X now, its Trichy 87, it is Trichy but not 87, table 1 is empty again, we carry these rows drop them there.

(Refer Slide Time: 23:53)

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}
  
```

Card	Student	Place	Maths	Gen
3	17 Arshad	Chennai	62	M
4	18 Abirami	Erode	72	F
5	19 Vetrivel	Trichy	56	M
6	20 Kalyan	Vellore	93	M
7	21 Monika	Bengaluru	78	F
8	22 Priya	Nagercoil	62	F
9	23 Deepika	Bengaluru	97	F
10	24 Siddharth	Madurai	44	M
11	25 Geeta	Chennai	87	F
12	26 JK	Chennai	74	M
13	27 Jagan	Madurai	81	M
14	28 Nisha	Madurai	74	F
15	29 Naveen	Vellore	72	M

Card	Student	Place	Maths	Gen
19	0 Bhuvanesh	Erode	68	M

Number of Comparisons
so far = $344 + 13 = 357$

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}
  
```

Number of Comparisons
so far = $357 + 12 = 369$

Card	Student	Place	Maths	Gen
30	18 Abirami	Erode	72	F
31*	19 Vetrivel	Trichy	56	M
32	20 Kalyan	Vellore	93	M
33	21 Monika	Bengaluru	78	F
34	22 Priya	Nagercoil	62	F
35	23 Deepika	Bengaluru	97	F
36	24 Siddharth	Madurai	44	M
37	25 Geeta	Chennai	87	F
38	26 JK	Chennai	74	M
39	27 Jagan	Madurai	81	M
40	28 Nisha	Madurai	74	F
41	29 Naveen	Vellore	72	M

Add 1000 more rows at bottom.

This is row X now. This is Chennai 62, this is Chennai but not 62, this is Chennai but not 62, table 1 is again empty, we pick up these rows drop them here.

(Refer Slide Time: 24:44)

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}
  
```

Number of Comparisons
so far = $369 + 11 = 380$

Card	Student	Place	Maths	Gen
31*	19 Vetrivel	Trichy	56	M
32	20 Kalyan	Vellore	93	M
33	21 Monika	Bengaluru	78	F
34	22 Priya	Nagercoil	62	F
35	23 Deepika	Bengaluru	97	F
36	24 Siddharth	Madurai	44	M
37	25 Geeta	Chennai	87	F
38	26 JK	Chennai	74	M
39	27 Jagan	Madurai	81	M
40	28 Nisha	Madurai	74	F
41	29 Naveen	Vellore	72	M

Add 1000 more rows at bottom.

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

1	Table 1				
2	Card	Student	Place	Mathematics	Gen
3	18	Abirami	Erode	72	F
4	19	Vetrivel	Trichy	56	M
5	20	Kalyan	Vellore	93	M
6	21	Monika	Bengaluru	78	F
7	22	Priya	Nagercoil	62	F
8	23	Deepika	Bengaluru	97	F
9	24	Siddharth	Madurai	44	M
10	25	Geeta	Chennai	87	F
11	26	JK	Chennai	74	M
12	27	Jagan	Madurai	81	M
13	28	Nisha	Madurai	74	F
14	29	Naveen	Vellore	72	M
15					
16	Table 2				
17	Card	Student	Place	Maths	Gen
18	0	Bhuvanesh	Erode	68	M
19	1	Harish	Salem	62	M
20					

This is row X now, which is Erode 72, table 1 is empty again these rows go up.

(Refer Slide Time: 25:22)

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

Number of Comparisons
so far = 380 + 10 = 390

25	19	Vetrivel	Trichy	56	M
26					
27					
28					
29					
30	Table 3				
31	Card	Student	Place	Maths	Gen
32	20	Kalyan	Vellore	93	M
33	21	Monika	Bengaluru	78	F
34	22	Priya	Nagercoil	62	F
35	23	Deepika	Bengaluru	97	F
36	24	Siddharth	Madurai	44	M
37	25	Geeta	Chennai	87	F
38	26	JK	Chennai	74	M
39	27	Jagan	Madurai	81	M
40	28	Nisha	Madurai	74	F
41	29	Naveen	Vellore	72	M

Add 1000 more rows at bottom.

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

1	Table 1				
2	Card	Student	Place	Mathematics	Gen
3	19	Vetrivel	Trichy	56	M
4	20	Kalyan	Vellore	93	M
5	21	Monika	Bengaluru	78	F
6	22	Priya	Nagercoil	62	F
7	23	Deepika	Bengaluru	97	F
8	24	Siddharth	Madurai	44	M
9	25	Geeta	Chennai	87	F
10	26	JK	Chennai	74	M
11	27	Jagan	Madurai	81	M
12	28	Nisha	Madurai	74	F
13	29	Naveen	Vellore	72	M
14					
15	Table 2				
16	Card	Student	Place	Maths	Gen
17	0	Bhuvanesh	Erode	68	M
18	1	Harish	Salem	62	M
19	2	Shashank	Chennai	57	M
20					

This is row X now, which is Trichy 56, table 1 is empty.

(Refer Slide Time: 25:51)

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

25	19	Vetrivel	Trichy	56	M
26	20	Kalyan	Vellore	93	M
27					
28					
29					
30					
31	Table 3				
32	Card	Student	Place	Maths	Gen
33	21	Monika	Bengaluru	78	F
34	22	Priya	Nagercoil	62	F
35	23	Deepika	Bengaluru	97	F
36	24	Siddharth	Madurai	44	M
37	25	Geeta	Chennai	87	F
38	26	JK	Chennai	74	M
39	27	Jagan	Madurai	81	M
40	28	Nisha	Madurai	74	F
41	29	Naveen	Vellore	72	M
42					

Number of Comparisons
so far = $390 + 9 = 399$

सद्विर्भवति कर्मजा

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}
  
```

Number of Comparisons
so far = $380 + 10 = 390$

Card	Student	Place	Mathematics	Gen
3	20 Kalyan	Vellore	93	M
4	21 Monika	Bengaluru	78	F
5	22 Priya	Nagercoil	62	F
6	23 Deepika	Bengaluru	97	F
7	24 Siddharth	Madurai	44	M
8	25 Geeta	Chennai	87	F
9	26 JK	Chennai	74	M
10	27 Jagan	Madurai	81	M
11	28 Nisha	Madurai	74	F
12	29 Naveen	Vellore	72	M

Card	Student	Place	Maths	Gen
16	0 Bhuvanesh	Erode	68	M
17	1 Harish	Salem	62	M
18	2 Shashank	Chennai	57	M
19	3 Rida	Chennai	42	F

This is our row X now, which is Vellore 93. Now, this is Vellore but not 93, so table 1 is empty.

(Refer Slide Time: 26:30)

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}
  
```

Number of Comparisons
so far = $390 + 9 = 399$

Card	Student	Place	Mathematics	Gen
3	21 Monika	Bengaluru	78	F
4	22 Priya	Nagercoil	62	F
5	23 Deepika	Bengaluru	97	F
6	24 Siddharth	Madurai	44	M
7	25 Geeta	Chennai	87	F
8	26 JK	Chennai	74	M
9	27 Jagan	Madurai	81	M
10	28 Nisha	Madurai	74	F
11	29 Naveen	Vellore	72	M

Card	Student	Place	Maths	Gen
15	0 Bhuvanesh	Erode	68	M
16	1 Harish	Salem	62	M
17	2 Shashank	Chennai	57	M
18	3 Rida	Chennai	42	F
19	4 Ritika	Madurai	87	F

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

**Number of Comparisons
so far = $399 + 8 = 407$**

25	19	Vetrivel	Trichy	56	M
26	20	Kalyan	Vellore	93	M
27	21	Monika	Bengaluru	78	F
28					
29					
30					
31					
32					
33	Card	Student	Place	Maths	Gen
34	22	Priya	Nagercoil	62	F
35	23	Deepika	Bengaluru	97	F
36	24	Siddharth	Madurai	44	M
37	25	Geeta	Chennai	87	F
38	26	JK	Chennai	74	M
39	27	Jagan	Madurai	81	M
40	28	Nisha	Madurai	74	F
41	29	Naveen	Vellore	72	M

Add 1000 more rows at bottom.

This is row X, Bengaluru 78, this is Bengaluru but 97 not 78, table 1 is now empty, bring back these rows from table 3.

(Refer Slide Time: 27:02)

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

**Number of Comparisons
so far = $407 + 7 = 414$**

25	19	Vetrivel	Trichy	56	M
26	20	Kalyan	Vellore	93	M
27	21	Monika	Bengaluru	78	F
28	22	Priya	Nagercoil	62	F
29					
30					
31					
32					
33	Card	Student	Place	Maths	Gen
34	23	Deepika	Bengaluru	97	F
35	24	Siddharth	Madurai	44	M
36	25	Geeta	Chennai	87	F
37	26	JK	Chennai	74	M
38	27	Jagan	Madurai	81	M
39	28	Nisha	Madurai	74	F
40	29	Naveen	Vellore	72	M
41					

Add 1000 more rows at bottom.

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

Number of Comparisons
so far = $399 + 8 = 407$

Table 1					
Card	Student	Place	Mathematics	Gen	
22	Priya	Nagercoil	62	F	
23	Deepika	Bengaluru	97	F	
24	Siddharth	Madurai	44	M	
25	Geeta	Chennai	87	F	
26	JK	Chennai	74	M	
27	Jagan	Madurai	81	M	
28	Nisha	Madurai	74	F	
29	Naveen	Vellore	72	M	
11					
12					
Table 2					
Card	Student	Place	Maths	Gen	
0	Bhuvanesh	Erode	68	M	
1	Harish	Salem	62	M	
2	Shashank	Chennai	57	M	
3	Rida	Chennai	42	F	
4	Ritika	Madurai	87	F	
5	Akshaya	Chennai	71	F	
20					

This is row X now that is Nagercoil 62, table 1 is empty, bring this back.

(Refer Slide Time: 27:32)

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

Number of Comparisons
so far = $414 + 6 = 420$

Table 3					
Card	Student	Place	Maths	Gen	
19	Vetrivel	Trichy	56	M	
20	Kalyan	Vellore	93	M	
21	Monika	Bengaluru	78	F	
22	Priya	Nagercoil	62	F	
23	Deepika	Bengaluru	97	F	
30					
31					
32					
33					
34					
24	Siddharth	Madurai	44	M	
25	Geeta	Chennai	87	F	
26	JK	Chennai	74	M	
27	Jagan	Madurai	81	M	
28	Nisha	Madurai	74	F	
29	Naveen	Vellore	72	M	
40					

Add 1000 more rows at bottom.

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}
  
```

**Number of Comparisons
so far = $407 + 7 = 414$**

Card	Student	Place	Mathematics	Gender
23	Deepika	Bengaluru	97	F
24	Siddharth	Madurai	44	M
25	Geeta	Chennai	87	F
26	JK	Chennai	74	M
27	Jagan	Madurai	81	M
28	Nisha	Madurai	74	F
29	Naveen	Vellore	72	M

Card	Student	Place	Maths	Gen
0	Bhuvanesh	Erode	68	M
1	Harish	Salem	62	M
2	Shashank	Chennai	57	M
3	Rida	Chennai	42	F
4	Ritika	Madurai	87	F
5	Akshaya	Chennai	71	F
6	Sameer	Ambur	81	M

This is our row X, which is Bengaluru to 97. Table 1 is empty, so bring back this.

(Refer Slide Time: 27:57)

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}
  
```

**Number of Comparisons
so far = $420 + 5 = 425$**

Card	Student	Place	Maths	Gen
19	Vetrivel	Trichy	56	M
20	Kalyan	Vellore	93	M
21	Monika	Bengaluru	78	F
22	Priya	Nagercoil	62	F
23	Deepika	Bengaluru	97	F
24	Siddharth	Madurai	44	M
25	Geeta	Chennai	87	F
26	JK	Chennai	74	M
27	Jagan	Madurai	81	M
28	Nisha	Madurai	74	F
29	Naveen	Vellore	72	M

Add 1000 more rows at bottom.

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
        and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

**Number of Comparisons
so far = 414 + 6 = 420**

Card	Student	Place	Mathematics	Gender
24	Siddharth	Madurai	44	M
25	Geeta	Chennai	87	F
26	JK	Chennai	74	M
27	Jagan	Madurai	81	M
28	Nisha	Madurai	74	F
29	Naveen	Vellore	72	M

Card	Student	Place	Maths	Gen
0	Bhuvanesh	Erode	68	M
1	Harish	Salem	62	M
2	Shashank	Chennai	57	M
3	Rida	Chennai	42	F
4	Ritika	Madurai	87	F
5	Akshaya	Chennai	71	F
6	Sameer	Ambar	81	M
7	Aditya	Vellore	84	M

This is our row X now which is Madurai 44. This is Madurai but not 44, again Madurai but not 44, table 1 is empty again.

(Refer Slide Time: 28:46)

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
        and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

**Number of Comparisons
so far = 425 + 4 = 429**

Card	Student	Place	Maths	Gen
19	Vetrivel	Trichy	56	M
20	Kalyan	Vellore	93	M
21	Monika	Bengaluru	78	F
22	Priya	Nagercoil	62	F
23	Deepika	Bengaluru	97	F
24	Siddharth	Madurai	44	M
25	Geeta	Chennai	87	F

Card	Student	Place	Maths	Gen
26	JK	Chennai	74	M
27	Jagan	Madurai	81	M
28	Nisha	Madurai	74	F
29	Naveen	Vellore	72	M

Add 1000 more rows at bottom.

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Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

**Number of Comparisons
so far = $420 + 5 = 425$**

Card	Student	Place	Mathematics	Gen
25	Geeta	Chennai	87	F
26	JK	Chennai	74	M
27	Jagan	Madurai	81	M
28	Nisha	Madurai	74	F
29	Naveen	Vellore	72	M
Card	Student	Place	Maths	Gen
0	Bhuvanesh	Erode	68	M
1	Harish	Salem	62	M
2	Shashank	Chennai	57	M
3	Rida	Chennai	42	F
4	Ritika	Madurai	87	F
5	Akshaya	Chennai	71	F
6	Sameer	Ambur	81	M
7	Aditya	Vellore	84	M
8	Surya	Bengaluru	74	M

This is row X, which is Chennai 87, this is Chennai but not 87, table 1 is empty again.

(Refer Slide Time: 29:05)

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

**Number of Comparisons
so far = $425 + 4 = 429$**

Card	Student	Place	Mathematics	Gen
26	JK	Chennai	74	M
27	Jagan	Madurai	81	M
28	Nisha	Madurai	74	F
29	Naveen	Vellore	72	M
Card	Student	Place	Maths	Gen
0	Bhuvanesh	Erode	68	M
1	Harish	Salem	62	M
2	Shashank	Chennai	57	M
3	Rida	Chennai	42	F
4	Ritika	Madurai	87	F
5	Akshaya	Chennai	71	F
6	Sameer	Ambur	81	M
7	Aditya	Vellore	84	M
8	Surya	Bengaluru	74	M
9	Clarence	Bengaluru	63	M

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

**Number of Comparisons
so far = $429 + 3 = 432$**

25	19	Vetrivel	Trichy	56	M
26	20	Kalyan	Vellore	93	M
27	21	Monika	Bengaluru	78	F
28	22	Priya	Nagercoil	62	F
29	23	Deepika	Bengaluru	97	F
30	24	Siddharth	Madurai	44	M
31	25	Geeta	Chennai	87	F
32	26	JK	Chennai	74	M
33					
34					
35					
36					
37			Table 3		
38	Card	Student	Place	Maths	Gen
39	27	Jagan	Madurai	81	M
40	28	Nisha	Madurai	74	F
41	29	Naveen	Vellore	72	M

This is our row X now, which is Chennai 74, table 1 is empty again.

(Refer Slide Time: 29:21)

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

**Number of Comparisons
so far = $429 + 3 = 432$**

1		Table 1			
2	Card	Student	Place	Mathematics	Gen
3	27	Jagan	Madurai	81	M
4	28	Nisha	Madurai	74	F
5	29	Naveen	Vellore	72	M
6					
7		Table 2			
8	Card	Student	Place	Maths	Gen
9	0	Bhuvanesh	Erode	68	M
10	1	Harish	Salem	62	M
11	2	Shashank	Chennai	57	M
12	3	Rida	Chennai	42	F
13	4	Ritika	Madurai	87	F
14	5	Akshaya	Chennai	71	F
15	6	Sameer	Ambur	81	M
16	7	Aditya	Vellore	84	M
17	8	Surya	Bengaluru	74	M
18	9	Clarence	Bengaluru	63	M
19	10	Kavya	Chennai	64	F

Count = 1

```

Count = 0
while (Table 1 has more rows) /
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

25	19	Vetrivel	Trichy	56	M
26	20	Kalyan	Vellore	93	M
27	21	Monika	Bengaluru	78	F
28	22	Priya	Nagercoil	62	F
29	23	Deepika	Bengaluru	97	F
30	24	Siddharth	Madurai	44	M
31	25	Geeta	Chennai	87	F
32	26	JK	Chennai	74	M
33	27	Jagan	Madurai	81	M
34					
35					
36					
37					
38	Card	Student	Place	Maths	Gen
39	28	Nisha	Madurai	74	F
40	29	Naveen	Vellore	72	M
	Add	1000	more rows at bottom.		

This is row X now and it is Madurai 81, this is Madurai but not 81, table 1 is empty again, we bring back the rows.

(Refer Slide Time: 29:42)

Count = 1

```

Count = 0
while (Table 1 has more rows) /
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

1	Table 1				
2	Card	Student	Place	Mathematics	Gen
3	29	Naveen	Vellore	72	M
4					
5	Table 2				
6	Card	Student	Place	Maths	Gen
7	0	Bhuvanesh	Erode	68	M
8	1	Harish	Salem	62	M
9	2	Shashank	Chennai	57	M
10	3	Rida	Chennai	42	F
11	4	Ritika	Madurai	87	F
12	5	Akshaya	Chennai	71	F
13	6	Sameer	Ambur	81	M
14	7	Aditya	Vellore	84	M
15	8	Surya	Bengaluru	74	M
16	9	Clarence	Bengaluru	63	M
17	10	Kavya	Chennai	64	F
18	11	Rahul	Bengaluru	97	M
19	12	Srinidhi	Chennai	52	F
20	20

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

**Number of Comparisons
so far = 432 + 2 = 434**

Card	Student	Place	Mathematics	Gender
28	Nisha	Madurai	74	F
29	Naveen	Vellore	72	M
Card	Student	Place	Maths	Gen
0	Bhuvanesh	Erode	68	M
1	Harish	Salem	62	M
2	Shashank	Chennai	57	M
3	Rida	Chennai	42	F
4	Ritika	Madurai	87	F
5	Akshaya	Chennai	71	F
6	Sameer	Ambur	81	M
7	Aditya	Vellore	84	M
8	Surya	Bengaluru	74	M
9	Clarence	Bengaluru	63	M
10	Kavya	Chennai	64	F
11	Rahul	Bengaluru	97	M
12				

This is row X now, which is Madurai 74 this is Vellore, it goes to table 3, now table 1 is empty. So, we are out of this block we have to do this line of code now which is carrying back this row here and now while table 1 still has rows, table 1 has 1 row

(Refer Slide Time: 30:17)

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

**Number of Comparisons
= 435**

Card	Student	Place	Mathematics	Gender
0	Bhuvanesh	Erode	68	M
1	Harish	Salem	62	M
2	Shashank	Chennai	57	M
3	Rida	Chennai	42	F
4	Ritika	Madurai	87	F
5	Akshaya	Chennai	71	F
6	Sameer	Ambur	81	M
7	Aditya	Vellore	84	M
8	Surya	Bengaluru	74	M
9	Clarence	Bengaluru	63	M
10	Kavya	Chennai	64	F
11	Rahul	Bengaluru	97	M
12	Srinidhi	Chennai	52	F
13	Gopi	Madurai	65	M
14				

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

**Number of Comparisons
so far = 435 + 0 = 435**

Card	Student	Place	Maths	Gen
25	19 Vetrivel	Trichy	56	M
26	20 Kalyan	Vellore	93	M
27	21 Monika	Bengaluru	78	F
28	22 Priya	Nagercoil	62	F
29	23 Deepika	Bengaluru	97	F
30	24 Siddharth	Madurai	44	M
31	25 Geeta	Chennai	87	F
32	26 JK	Chennai	74	M
33	27 Jagan	Madurai	81	M
34	28 Nisha	Madurai	74	F
35	29 Naveen	Vellore	72	M
36				
37				
38				
39				
40	Table 3			
41	Add	1000	more rows at bottom.	

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

Card	Student	Place	Maths	Gen
22	16 Tauseef	Trichy	87	M
23	17 Arshad	Chennai	62	M
24	18 Abirami	Erode	72	F
25	19 Vetrivel	Trichy	56	M
26	20 Kalyan	Vellore	93	M
27	21 Monika	Bengaluru	78	F
28	22 Priya	Nagercoil	62	F
29	23 Deepika	Bengaluru	97	F
30	24 Siddharth	Madurai	44	M
31	25 Geeta	Chennai	87	F
32	26 JK	Chennai	74	M
33	27 Jagan	Madurai	81	M
34	28 Nisha	Madurai	74	F
35	29 Naveen	Vellore	72	M
36				
37				
38				
39				
40	Table 3			

Count = 1

```

Count = 0
while (Table 1 has more rows) {
    Read the first row X in Table 1
    Move X to Table 2
    while (Table 1 has more rows) {
        Read the first row Y in Table 1
        if (X.Place == Y.Place
            and X.Mathematics == Y.Mathematics)
            { Count = Count + 1}
        Move Y to Table 3
    }
    Move all rows from Table 3 to Table 1
}

```

1	Table 1				
2	Card	Student	Place	Mathematics	Gender
3	29	Naveen	Vellore	72	M
4					
5	Table 2				
6	Card	Student	Place	Maths	Gen
7	0	Bhuvanesh	Erode	68	M
8	1	Harish	Salem	62	M
9	2	Shashank	Chennai	57	M
10	3	Rida	Chennai	42	F
11	4	Ritika	Madurai	87	F
12	5	Akshaya	Chennai	71	F
13	6	Sameer	Ambur	81	M
14	7	Aditya	Vellore	84	M
15	8	Surya	Bengaluru	74	M
16	9	Clarence	Bengaluru	63	M
17	10	Kavya	Chennai	64	F
18	11	Rahul	Bengaluru	97	M
19	12	Srinidhi	Chennai	52	F
20					

Read the first row, which is this, this is our row X, move it to table 2. And now while table 1 has more rows is not satisfied, table 1 is now empty. So, we just come here and we also see that table 3 is also empty, so we go back to the top which again checks whether table 1 has more rows, it does not, so we are out of this while loop and this code is done. And we have done a lot of iterations, we have done over all 435 comparisons, that would be 30 into 29 by 2, according to the formula used by the process. Now let us, look at what happens in binning.

(Refer Slide Time: 31:11)

```

while (Table 1 has more rows) {
    Read the first row X in Table 1
    if (X.Place == "Ambur")/
        Move X to Table-Ambur
    /
    if (X.Place == "Bengaluru")/
        Move X to Table-Bengaluru
    /
    if (X.Place == "Chennai")/
        Move X to Table-Chennai
    /
    if (X.Place == "Erode")/
        Move X to Table-Erode
    /
    if (X.Place == "Madurai")/
        Move X to Table-Madurai
    /
    if (X.Place == "Salem")/
        Move X to Table-Salem
    /
}

```

1	Table 1				
2	Card	Student	Place	Mathematics	Gender
3	0	Bhuvanesh	Erode	68	M
4	1	Harish	Salem	62	M
5	2	Shashank	Chennai	57	M
6	3	Rida	Chennai	42	F
7	4	Ritika	Madurai	87	F
8	5	Akshaya	Chennai	71	F
9	6	Sameer	Ambur	81	M
10	7	Aditya	Vellore	84	M
11	8	Surya	Bengaluru	74	M
12	9	Clarence	Bengaluru	63	M
13	10	Kavya	Chennai	64	F
14	11	Rahul	Bengaluru	97	M
15	12	Srinidhi	Chennai	52	F
16	13	Gopi	Madurai	65	M
17	14	Sophia	Trichy	89	F
18	15	Goutami	Theni	76	F
19	16	Tauseef	Trichy	87	M
20	17	Arshad	Chennai	62	M
21	18	Abirami	Erode	72	F
22	19	Vetrivel	Trichy	56	M
23					

```

while (Table 1 has more rows) {
    Read the first row X in Table 1
    if (X.Place == "Ambur")/
        Move X to Table-Ambur
    }
    if (X.Place == "Bengaluru")/
        Move X to Table-Bengaluru
    }
    if (X.Place == "Chennai")/
        Move X to Table-Chennai
    }
    if (X.Place == "Erode")/
        Move X to Table-Erode
    }
    if (X.Place == "Madurai")/
        Move X to Table-Madurai
    }
    if (X.Place == "Salem")/
        Move X to Table-Salem
    }
}

```

Table-Salem				
Card	Student	Place	Maths	Gender
1	Harish	Salem	62	M

Table-Trichy				
Card	Student	Place	Maths	Gender
14	Sophia	Trichy	89	F
16	Tauseef	Trichy	87	M
19	Vetrivel	Trichy	56	M

Table-Vellore				
Card	Student	Place	Maths	Gender
7	Aditya	Vellore	84	M
20	Kalyan	Vellore	93	M

Table-Theni				
Card	Student	Place	Maths	Gender
15	Goutami	Theni	76	F

Table-Nagercoil				
Card	Student	Place	Maths	Gender
22	DS	Nagercoil	88	F

Now, here we are going to try the binning approach and we are going to bin according to the place, so all rows of one place will be binned together, this is the pseudo code for that and here we see these various tables, table Ambur, table Bengaluru, table Chennai etc. So, all these tables we have placed them under table 1, which are like this. And what this code tells us to do is while table 1 has more rows, so we go through table 1 pick row by row read the first row X in table 1, so we pick row by row and then if depending on X's place, we move it to that corresponding table.

So, let us do this one by one now, here this is our row X now, this is Erode, so we take it to Erode's table. So, that is in table Erode and likewise this goes to the Salem table, this goes to Chennai table, again Chennai table, Madurai table, Chennai table again, Ambur table, table Vellore, table Bengaluru, Bengaluru again, Chennai, Bengaluru again, Chennai, Madurai, Trichy, Theni, table Trichy, Chennai, table Erode, table Trichy, table Vellore, Bengaluru is here.

Table Nagercoil, one more Bengaluru, Madurai table, Chennai table, table Chennai again, one more Madurai table and one more for table Madurai and lastly, we have one for table Vellore. Now, table 1 is empty, there are no more row. So, we are out of this while loop, so binning is over, there is nothing outside of the loop for us now.

(Refer Slide Time: 34:25)



Card	Student	Place	Maths	Gender
6	Sameer	Ambur	81	M
Table-Ambur				
Card	Student	Place	Maths	Gender
8	Surya	Bengaluru	74	M
9	Clarence	Bengaluru	63	M
10	Rahul	Bengaluru	97	M
11	Monika	Bengaluru	78	F
12	Deepika	Bengaluru	97	F
Table-Bengaluru				
Card	Student	Place	Maths	Gender
16	Table-Chennai			
Card	Student	Place	Maths	Gender
18	2 Shashank	Chennai	57	M
19	3 Rida	Chennai	42	F
20	5 Akshaya	Chennai	71	F
21	10 Kavya	Chennai	64	F
22	12 Srinidhi	Chennai	52	F
23	17 Arshad	Chennai	62	M
24	25 Geeta	Chennai	87	F
...

And now once the binning is done for each of these tables, we run this code which is pretty much identical to what we had done with table 1 earlier here. However, we run it for each city table, so we run it for table Ambur, we run it for table Bengaluru, we run it for table Chennai. So, on for every city table. The code is very much the same you read the first row X in that particular city table you move it, you move that row to table 2 and while that city table still has more rows you read the first row in that city table.

And here the only difference is in the if condition we do not have an AND statement because we no longer need to check for the same place. Because every row in that particular city table will have the same place, so we are only checking for mathematics scores and in case they are equal then we increase the count. And after that we move this Y row to table 3 and finally all table 3 rows are moved back to the city table. So, this way this code is very, very much identical to what we had done earlier except now we do it city by city. So, we can now look at the number of comparisons it is going to take. For that let us look at how many rows are there per city.

(Refer Slide Time: 35:58)

Card	Student	Gender	D.O.B	Place	Math	Physics	Chem	Total	Number of Col
26	JK	M	22 Jul	Chennai	74	71	82	227	
0	Bhuvanesh	M	7 Nov	Erode	68	64	78	210	1
18	Abirami	F	9 Oct	Erode	72	92	97	261	
4	Ritika	F	17 Nov	Madurai	87	64	89	240	
13	Gopi	M	6 May	Madurai	65	73	89	227	
24	Siddharth	M	26 Dec	Madurai	44	72	58	174	10
27	Jagan	M	4 Mar	Madurai	81	76	52	209	
			10 Sep	Madurai	74	83	83	240	
			17 Jul	Nagercoil	62	62	57	181	0
			3 Jun	Salem	62	45	91	198	0
			2 Sep	Theni	76	58	90	224	0
			8 July	Trichy	89	62	93	244	
16	Tauseef	M	30 Dec	Trichy	87	86	43	216	3
19	Vetrivel	M	30 Aug	Trichy	56	78	62	196	

$$1 \times (1-1)/2 = 0$$

n is the number of rows in that table.

Card	Student	Gender	D.O.B	Place	Math	Physics	Chem	Total	Number of Col
6	Sameer	M	23 Mar	Ambur	81	82	87	250	0
8	Surya	M	28 Feb	Bengaluru	74	64	51	189	
9	Clarence	M	6 Dec	Bengaluru	63	88	73	224	
11	Rahul	M	30 Apr	Bengaluru	97	92	92	281	10
21	Monika	F	15 Mar	Bengaluru	78	69	74	221	
23	Deepika	F	13 May	Bengaluru	97	91	88	276	
2	Shashank	M	4 Jan	Chennai	57	54	77	188	
			5 May	Chennai	42	53	78	173	
			3 Feb	Chennai	71	92	84	247	
			2 Jan	Chennai	64	72	68	204	
			4 Jan	Chennai	52	64	71	187	28
			4 Dec	Chennai	62	81	67	210	
25	Geeta	F	16 May	Chennai	87	75	92	254	
26	JK	M	22 Jul	Chennai	74	71	82	227	

$$8 \times (8-1)/2 = 28$$

n is the number of rows in that table.

Card	Student	Gender	D.O.B	Place	Math	Physics	Chem	Total	Number of Comparisons
6	Sameer	M	23 Mar	Ambur	81	82	87	250	0
8	Surya	M	28 Feb	Bengaluru	74	64	51	189	
9	Clarence	M	6 Dec	Bengaluru	63	88	73	224	
11	Rahul	M	30 Apr	Bengaluru	97	92	92	281	10
21	Monika	F	15 Mar	Bengaluru	78	69	74	221	
23	Deepika	F	13 May	Bengaluru	97	91	88	276	
2	Shashank	M	4 Jan	Chennai	57	54	77	188	
1			6 May	Chennai	42	53	78	173	
1			8 Feb	Chennai	71	92	84	247	
1			2 Jan	Chennai	64	72	68	204	
1			4 Jan	Chennai	52	64	71	187	
1			4 Dec	Chennai	62	81	67	210	
25	Geeta	F	16 May	Chennai	87	75	92	254	
26	JK	M	22 Jul	Chennai	74	71	82	227	

n is the number of rows in that table.

Card	Student	Gender	D.O.B	Place	Math	Physics	Chem	Total	Number of Comparisons
27	Jagan	M	4 Mar	Madurai	81	76	52	209	
28	Nisha	F	10 Sep	Madurai	74	83	83	240	
22	Priya	F	17 Jul	Nagercoil	62	62	57	181	0
1	Harish	M	3 Jun	Salem	62	45	91	198	0
15	Goutami	F	22 Sep	Theni	76	58	90	224	0
14	Sophia	F	23 July	Trichy	89	62	93	244	
16	Tauseef	M	30 Dec	Trichy	87	86	43	216	3
19	Vetrivel	M	30 Aug	Trichy	56	78	62	196	
7	Aditya	M	15 Mar	Vellore	84	92	76	252	
20	Kalyan	M	17 Sep	Vellore	93	68	91	252	3
29	Naveen	M	13 Oct	Vellore	72	66	81	219	

55

So, here we see the number of comparisons that we do per city. So, per table how many comparisons comes out and this goes to the formula n into n minus 1 by 2 where n is the number of rows in that particular table.

So, Ambur has only 1 row, so you will get 1 into 0 by 2, which is 0 comparisons, Bengaluru has 1, 2, 3, 4, 5, 5 rows, so you get 5 into 4 by 2 that is 10, Chennai has 1, 2, 3, 4, 5, 6, 7, 8, so 8 into 7 by 2 which is 28. And Erode has 2, so 2 into 1 by 2, which is 1, Madurai has 5 so 5 into 4 by 2 which is 10 again.

Nagercoil is a single row table, so you will get 0 comparison, Salem has 0 comparisons, Theni also has 0 comparisons, Trichy there are 3 rows, so 3 into 2 by 2, which has 3 comparisons, same

with Vellore 3 rows 3 into 2 by 2 is 3 comparisons. And the total number of comparisons is now only 55. Earlier in the table 1 we had done 435 comparisons overall.

So, this wave binning drastically reduces the number of comparisons, if the data is reasonably distributed across various bins. As the professors have indicated, if all the rows were to go into one table suppose everybody is from the same city, then you will again have to do 435 comparisons, but here they are quite distributed therefore we have gotten much lesser number of comparisons. Thank you.

