

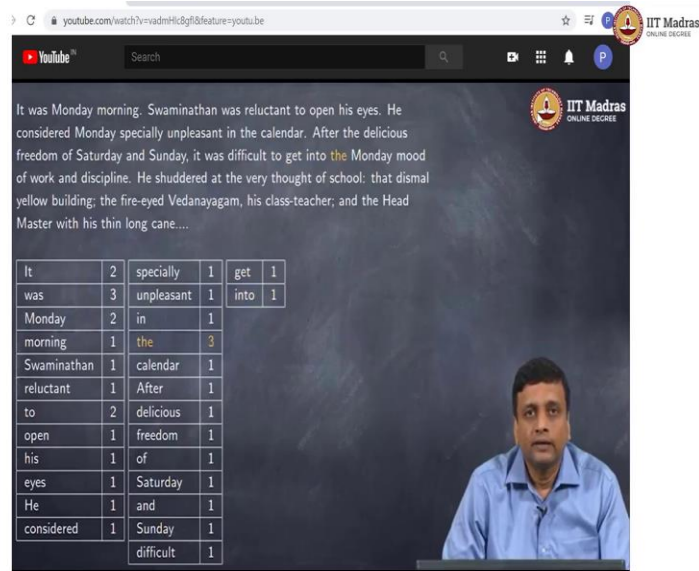


IIT Madras

ONLINE DEGREE

Computational Thinking Tutorial 2.5

(Refer Slide Time: 0:14)



The screenshot shows a YouTube video player with a paragraph of text and a word frequency table. The paragraph is: "It was Monday morning. Swaminathan was reluctant to open his eyes. He considered Monday specially unpleasant in the calendar. After the delicious freedom of Saturday and Sunday, it was difficult to get into the Monday mood of work and discipline. He shuddered at the very thought of school: that dismal yellow building; the fire-eyed Vedanayagam, his class-teacher; and the Head Master with his thin long cane...."

It	2	specially	1	get	1
was	3	unpleasant	1	into	1
Monday	2	in	1		
morning	1	the	3		
Swaminathan	1	calendar	1		
reluctant	1	After	1		
to	2	delicious	1		
open	1	freedom	1		
his	1	of	1		
eyes	1	Saturday	1		
He	1	and	1		
considered	1	Sunday	1		
		difficult	1		

Hello CT students. In lecture 15 professor Madhavan Mukund had shown the procedure to find the frequency of every individual word in the paragraph. So, for each new word we encounter, we declare a new variable, keep its frequency 0 and incremented by 1. And when we come to a word which is already there whose frequency was already 1, then we increment it to 2. So, this way we keep increasing the frequency every time we see the word again. And when we find a new word we add a new variable, initialize it to 0 and increment it by 1. We are going to do a similar procedure now with the shopping bill dataset.

(Refer Slide Time: 1:01)

SV Stores		Srivatsan 1		
Item	Category	Qty	Price	Cost
Carrots	Vegetables/Food	1.5	50	75
Soap	Toiletries	4	32	128
Tomatoes	Vegetables/Food	2	40	80
Bananas	Vegetables/Food	8	8	64
Socks	Footwear/Apparel	3	56	168
Curd	Dairy/Food	0.5	32	16
Milk	Dairy/Food	1.5	24	36
				567

Srivatsan = 1

We are going to find the number of bills per customer in this dataset. So, for this every time we encounter a new customer, we declare a new variable, initialize it to 0 and increment it by 1 and each time that customer shows up again we will increment that variable by 1. So, here let us begin we have Srivatsan, this is our first card Srivatsan for SV Stores. So, let us declare a variable for Srivatsan and we initialize it to 0 and then we increment it by 1.

(Refer Slide Time: 1:44)

Big Bazaar		Sudeep 2		
Item	Category	Qty	Price	Cost
Baked Beans	Canned/Food	1	125	125
Chicken Wings	Meat/Food	0.5	600	300
Cocoa powder	Canned/Food	1	160	160
Capsicum	Vegetables/Food	0.8	180	144
Tie	Apparel	2	390	780
Clips	Household	0.5	32	16
				1525

Srivatsan = 1

Sudeep = 1

Now, we have Sudeep who again we initialize to 0 and increment by 1.

(Refer Slide Time: 1:51)

SV Stores		Akshaya 3			
Item	Category	Qty	Price	Cost	
Face Wash	Toiletries	1	89	89	
Shampoo	Toiletries	1	140	140	
Onions	Vegetables/Food	1	98	98	
Bananas	Fruits/Food	4	8	32	
Milk	Dairy/Food	1	24	24	
Biscuits	Packed/Food	2	22	44	
Maggi	Packed/Food	1	85	85	
Horlicks	Packed/Food	1	270	270	
Chips	Packed/Food	1	20	20	
Chocolates	Packed/Food	4	10	40	
Cereal	Packed/Food	1	220	220	
Handwash	Toiletries	1	139	139	
Air freshener	Toiletries	2	70	140	
				1341	

Sriratsan = \emptyset 1

Sudeep = \emptyset 1

Akshaya = \emptyset 1

Now, we have Akshaya, again 0, 1.

(Refer Slide Time: 1:59)

SV Stores		Advaith 4			
Item	Category	Qty	Price	Cost	
Milk	Dairy/Food	2	24	48	
Bread	Packed/Food	1	30	30	
Eggs	Food	1	45	45	
				123	

Sriratsan = \emptyset 1

Sudeep = \emptyset 1

Akshaya = \emptyset 1

Advaith = \emptyset 1

Then there is Advaith, again 0, 1.

(Refer Slide Time: 2:08)

Big Bazaar		Akshaya 5		
Item	Category	Qty	Price	Cost
Trousers	Women/Apparel	2	870	1740
Shirts	Women/Apparel	1	1350	1350
Detergent	Household	0.5	270	135
Tee shirts	Women/Apparel	4	220	880
Instant Noodles	Canned/Food	3	23	69
				4174

Srivatsan = $\emptyset 1$
Sudeep = $\emptyset 1$
Akshaya = $\emptyset 1/2$
Advaith = $\emptyset 1$

Now, there is Akshaya again, therefore 1 now becomes 2, so Akshaya variable is incremented by 1.

(Refer Slide Time: 2:19)

Sun General		Srivatsan 6		
Item	Category	Qty	Price	Cost
Batteries	Utilities	6	14	84
USB Cable	Electronics	1	85	85
Ball Pens	Stationery	5	12	60
Onions	Vegetables/Food	1.25	100	125
				354

Srivatsan = $\emptyset 1/2$
Sudeep = $\emptyset 1$
Akshaya = $\emptyset 1/2$
Advaith = $\emptyset 1$

There is Srivatsan again, so srivatsan goes from 1 to 2.

(Refer Slide Time: 2:26)

SV Stores					Akhil 7
Item	Category	Qty	Price	Cost	
Bread	Packed/Food	1	30	30	
Biscuits	Packed/Food	3	22	66	
				96	

Sriratsan = $\phi \times 2$
Sudeep = $\phi 1$
Akhaya = $\phi \times 2$
Advaith = $\phi 1$
Akhil = $\phi 1$

Now, we have Akhil who is new. So, we have Akhil being 0 and then incremented to 1.

(Refer Slide Time: 2:38)

Big Bazaar					Mohith 9
Item	Category	Qty	Price	Cost	
Lindt	Chocolate/Food	1	125	125	
Socks	Footwear/Apparel	1	120	120	
Spring Onions	Vegetables/Food	0.5	220	110	
Lettuce	Vegetables/Food	0.6	150	90	
Cookies	Snacks/Food	2	75	150	
				595	

Sriratsan = $\phi \times 2$
Sudeep = $\phi 1$
Akhaya = $\phi \times 2$
Advaith = $\phi \times 2$
Akhil = $\phi 1$

Advaith is back, so 1 is now incremented to 2.

(Refer Slide Time: 2:46)

Big Bazaar		Mohith 9			
Item	Category	Qty	Price	Cost	
Lindt	Chocolate/Food	1	125	125	
Socks	Footwear/Apparel	1	120	120	
Spring Onions	Vegetables/Food	0.5	220	110	
Lettuce	Vegetables/Food	0.6	150	90	
Cookies	Snacks/Food	2	75	150	

Sriratsan = $\phi \times 2$
Sudeep = $\phi 1$
Akshaya = $\phi \times 2$
Advaith = $\phi \times 2$
Akhil = $\phi 1$
Mohith = $\phi 1$

Mohith is new so we have initialization to 0 and incrementing by 1.

(Refer Slide Time: 2:59)

Sun General		Rajesh 10			
Item	Category	Qty	Price	Cost	
Notebooks	Stationery	3	20	60	
Apples	Fruits/Food	6	24	144	
Pears	Fruits/Food	4	30	120	
Chart Paper	Stationery	2	22	44	
Ruler	Stationery	1	10	10	

Sriratsan = $\phi \times 2$
Sudeep = $\phi 1$
Akshaya = $\phi \times 2$
Advaith = $\phi \times 2$
Akhil = $\phi 1$
Mohith = $\phi 1$
Rajesh = $\phi 1$

And Rajesh is also new, we do the same thing which is initialized to 0, increment by 1.

(Refer Slide Time: 3:10)

SV Stores					Abhinav 11
Item	Category	Qty	Price	Cost	
Chocolates	Packed/Food	1	10	10	
Cereal	Packed/Food	1	220	220	
Bananas	Fruits/Food	6	8	48	
Tomatoes	Vegetables/Food	1	40	40	
Curd	Dairy/Food	1	32	32	
Milk	Dairy/Food	2	24	48	
Horlicks	Packed/Food	1	270	270	
Plates	Household	4	45	180	
Eggs	Food	1	45	45	
					893

Sriratsan = $\phi \times 2$
Sudeep = ϕ
Akhaya = $\phi \times 2$
Advaith = $\phi \times 2$
Akhil = ϕ
Mohith = ϕ
Rajesh = ϕ
Abhinav = ϕ

And Abhinav is new, so 0 and then 1.

(Refer Slide Time: 3:19)

Sun General					Aparna 12
Item	Category	Qty	Price	Cost	
Mosquito Coil	Household	2	24	48	
Bananas	Fruits/Food	6	5	30	
Ball Pens	Stationery	4	12	48	
Paper Clips	Stationery	1	60	60	
					186

Sriratsan = $\phi \times 2$
Sudeep = ϕ
Akhaya = $\phi \times 2$
Advaith = $\phi \times 2$
Akhil = ϕ
Mohith = ϕ
Rajesh = ϕ
Abhinav = ϕ
Aparna = ϕ

Aparna is new, 0, 1.

(Refer Slide Time: 3:26)

Big Bazaar					Abhinav	13
Item	Category	Qty	Price	Cost		
Shoes	Footwear/Apparel	1	2700	2700		
Polish	Footwear/Apparel	1	120	120		
Socks	Footwear/Apparel	2	120	240		
				3060		
					Next	

Sriratsan = $\phi \times 12$
Sudeep = ϕ
Akhaya = $\phi \times 2$
Advaith = $\phi \times 2$
Akhil = ϕ
Mohith = ϕ
Rajesh = ϕ
Abhinav = $\phi \times 12$
Aarna = ϕ

Abhinav is there already so we go from 1 to 2.

(Refer Slide Time: 3:32)

Sun General					Vignesh	14
Item	Category	Qty	Price	Cost		
Phone Charger	Utilities	1	230	230		
Razor Blades	Grooming	1	12	12		
Razor	Grooming	1	45	45		
Shaving Lotion	Grooming	0.8	180	144		
Earphones	Electronics	1	210	210		
Pencils	Stationery	3	5	15		
				656		

Sriratsan = $\phi \times 12$
Sudeep = ϕ
Akhaya = $\phi \times 2$
Advaith = $\phi \times 2$
Akhil = ϕ
Mohith = ϕ
Rajesh = ϕ
Abhinav = $\phi \times 12$
Aarna = ϕ
Vignesh = ϕ

Vignesh is new, so we are now initializing to 0 and incrementing by 1.

(Refer Slide Time: 3:42)

Sun General					Abhinav 15
Item	Category	Qty	Price	Cost	
Keyboard	Toiletries	1	89	89	
Mouse	Toiletries	1	140	140	
					229

Sriratsan = $\emptyset \times 2$
Sudeep = $\emptyset 1$
Akhaya = $\emptyset \times 2$
Advaith = $\emptyset \times 2$
Akhil = $\emptyset 1$
Mohith = $\emptyset 1$
Rajesh = $\emptyset 1$
Abhinav = $\emptyset \times 2, 3$
Aarna = $\emptyset 1$
Vignesh = $\emptyset 1$

Abhinav is there again, so Abhinav is probably the current maximum.

(Refer Slide Time: 3:48)

Sun General					Advaith 16
Item	Category	Qty	Price	Cost	
Pencils	Stationery	2	5	10	
Notebooks	Stationery	4	20	80	
Geometry Box	Stationery	1	72	72	
Graph Book	Stationery	1	25	25	
					187

Sriratsan = $\emptyset \times 2$
Sudeep = $\emptyset 1$
Akhaya = $\emptyset \times 2$
Advaith = $\emptyset \times 2, 3$
Akhil = $\emptyset 1$
Mohith = $\emptyset 1$
Rajesh = $\emptyset 1$
Abhinav = $\emptyset \times 2, 3$
Aarna = $\emptyset 1$
Vignesh = $\emptyset 1$

Advaith is there, Advaita is also on three right now.

(Refer Slide Time: 3:53)

SV Stores					George 17
Item	Category	Qty	Price	Cost	
Cereal	Packed/Food	1	220	220	
Milk	Dairy/Food	1	24	24	
Cupcakes	Packed/Food	1	25	25	
Chocolates	Packed/Food	1	10	10	
					279

Sriratsan = $\phi \times 2$
Sudeep = ϕ
Akhaya = $\phi \times 2$
Advaith = $\phi \times 2 \times 3$
Akhil = ϕ
Mohith = ϕ
Rajesh = ϕ
Abhinav = $\phi \times 2 \times 3$
Aarna = ϕ
Vignesh = ϕ
George = ϕ

George is new, so 0 and 1.

(Refer Slide Time: 4:02)

SV Stores					Ahmed 18
Item	Category	Qty	Price	Cost	
Tomatoes	Vegetables/Food	1	40	40	
Curd	Dairy/Food	1	32	32	
Cupcakes	Packed/Food	2	25	50	
Carrots	Vegetables/Food	1.5	50	75	
Beans	Vegetables/Food	1	45	45	
Onions	Vegetables/Food	0.5	98	49	
Turmeric	Packed/Food	1	82	82	
Ghee	Packed/Food	1	230	230	
					603

Sriratsan = $\phi \times 2$
Sudeep = ϕ
Akhaya = $\phi \times 2$
Advaith = $\phi \times 2 \times 3$
Akhil = ϕ
Mohith = ϕ
Rajesh = ϕ
Abhinav = $\phi \times 2 \times 3$
Aarna = ϕ
Vignesh = ϕ
George = ϕ
Ahmed = ϕ

Ahmed is also new, so initialize to 0 increment to 1.

(Refer Slide Time: 4:10)

SV Stores					Neeraja 19
Item	Category	Qty	Price	Cost	
Carrots	Vegetables/Food	1	50	50	
Horlicks	Packed/Food	1	270	270	
Chips	Packed/Food	1	20	20	
Kajal	Cosmetics	1	180	180	
Milk	Dairy/Food	3	24	72	
					592

Neeraja = 01
Sriratsan = 012
Sudeep = 01
Akhaya = 012
Advaith = 0123
Akhil = 01
Mohith = 01
Rajesh = 01
Abhinav = 0123
Aarna = 01
Vignesh = 01
George = 01
Ahmed = 01



Neeraja is new, Neeraja initialize to 0 increment to 1.

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SV Stores					Ahmed 20
Item	Category	Qty	Price	Cost	
Tomatoes	Vegetables/Food	2	40	80	
Curd	Dairy/Food	2	32	64	
Cupcakes	Packed/Food	3	25	75	
Carrots	Vegetables/Food	0.5	50	25	
Onions	Vegetables/Food	1	98	98	
Handwash	Toiletries	1	139	139	
Bananas	Fruits/Food	12	8	96	
Eggs	Food	1	45	45	
					622

Neeraja = 01
Sriratsan = 012
Sudeep = 01
Akhaya = 012
Advaith = 0123
Akhil = 01
Mohith = 01
Rajesh = 01
Abhinav = 0123
Aarna = 01
Vignesh = 01
George = 01
Ahmed = 012



Ahmed this is here again, so 2.

(Refer Slide Time: 4:25)

SV Stores		Akshaya 21		
Item	Category	Qty	Price	Cost
Curd	Dairy/Food	0.5	32	16
Butter	Dairy/Food	0.2	320	64
Milk	Dairy/Food	2	24	48
				128

Neesaja = \emptyset 1
Sriratsan = \emptyset 12
Sudeep = \emptyset 1
Akshaya = \emptyset 123
Advait = \emptyset 123
Akhil = \emptyset 1
Mohith = \emptyset 1
Rajesh = \emptyset 1
Abhinav = \emptyset 123
Aarna = \emptyset 1
Vignesh = \emptyset 1
George = \emptyset 1
Ahmed = \emptyset 12



Akshaya is there again, so 3.

(Refer Slide Time: 4:30)

Sun General		Suresh 22		
Item	Category	Qty	Price	Cost
Batteries	Utilities	2	14	28
Tomatoes	Vegetables/Food	1.5	80	120
Spinach	Vegetables/Food	1	15	15
Bananas	Fruits/Food	4	5	20
Mosquito coils	Household	1	24	24
Guava	Fruits/Food	0.4	120	48
Potato	Vegetables/Food	1.5	40	60
				315

Sudeep = \emptyset 1
Akshaya = \emptyset 123
Advait = \emptyset 123
Akhil = \emptyset 1
Mohith = \emptyset 1
Rajesh = \emptyset 1
Abhinav = \emptyset 123
Aarna = \emptyset 1
Vignesh = \emptyset 1
George = \emptyset 1
Ahmed = \emptyset 12
Suresh = \emptyset 1



Suresh is new, so Suresh is initialized to 0 and incremented to 1.

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SV Stores					Julia 23
Item	Category	Qty	Price	Cost	
Carrots	Vegetables/Food	1.5	50	75	
Bananas	Fruits/Food	12	8	96	
Curd	Dairy/Food	3	32	96	
Milk	Dairy/Food	4	24	96	
Cereal	Packed/Food	2	220	440	
Maggi	Packed/Food	1	85	85	
					888

Sudeep = $\emptyset 1$
 Akhaya = $\emptyset 1 \times 3$
 Advait = $\emptyset 1 \times 3$
 Akhil = $\emptyset 1$
 Mohith = $\emptyset 1$
 Rajesh = $\emptyset 1$
 Abhinav = $\emptyset 1 \times 3$
 Aparna = $\emptyset 1$
 Vignesh = $\emptyset 1$
 George = $\emptyset 1$
 Ahmed = $\emptyset 1 \times 2$
 Suresh = $\emptyset 1$
 Julia = $\emptyset 1$

Julia is also new, so 0 and 1.

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SV Stores					Neeraja 24
Item	Category	Qty	Price	Cost	
Milk	Dairy/Food	3	24	72	
Chips	Packed/Food	1	20	20	
					92

Neeraja = $\emptyset 1 \times 2$
 Sriratsan = $\emptyset 1 \times 2$
 Sudeep = $\emptyset 1$
 Akhaya = $\emptyset 1 \times 3$
 Advait = $\emptyset 1 \times 3$
 Akhil = $\emptyset 1$
 Mohith = $\emptyset 1$
 Rajesh = $\emptyset 1$
 Abhinav = $\emptyset 1 \times 3$
 Aparna = $\emptyset 1$
 Vignesh = $\emptyset 1$
 George = $\emptyset 1$

Neeraja was there already, Neeraja is here, so neeraj is now on 2.

(Refer Slide Time: 4:57)

Sun General Ahmed 25				
Item	Category	Qty	Price	Cost
Earphones	Electronics	1	210	210
Phone cover	Accessories	1	140	140
Dongle	Electronics	1	790	790
A4 sheets	Stationery	200	1	200
Ball Pens	Stationery	2	12	24
				1364

Akhaya = $\phi \times 23$
Advaith = $\phi \times 23$
Akil = $\phi 1$
Mohith = $\phi 1$
Rajesh = $\phi 1$
Abhinav = $\phi \times 23$
Aarna = $\phi 1$
Vignesh = $\phi 1$
George = $\phi 1$
Ahmed = $\phi \times 23$
Suresh = $\phi 1$
Julia = $\phi 1$

Ahmed was also there, so Ahmed is now on 3.

(Refer Slide Time: 5:04)

Sun General Srivatsan 27				
Item	Category	Qty	Price	Cost
Broom	Household	1	70	70
Dustpan	Household	1	45	45
Floor Cleaner	Household	1	125	125
Tissue Paper	Household	2	50	100
				340

Neesaja = $\phi \times 2$
Srivatsan = $\phi \times 24$
Sudeep = $\phi 1$
Akhaya = $\phi \times 23$
Advaith = $\phi \times 23$
Akil = $\phi 1$
Mohith = $\phi 1$
Rajesh = $\phi 1$
Abhinav = $\phi \times 23$
Aarna = $\phi 1$
Vignesh = $\phi 1$
George = $\phi 1$
Ahmed = $\phi \times 23$

Srivatsan is also now on 3, Srivatsan is now on 4.

(Refer Slide Time: 5:13)

SV Stores		Vignesh 28			
Item	Category	Qty	Price	Cost	
Face Wash	Toiletries	1	89	89	
Shampoo	Toiletries	1	140	140	
Maggi	Packed/Food	1	85	85	
Chips	Packed/Food	1	20	20	
Chocolates	Packed/Food	4	10	40	
Air Freshener	Toiletries	2	70	140	
					514

Judeep = $\emptyset 1$
 Akhaya = $\emptyset 1 \times 3$
 Advait = $\emptyset 1 \times 3$
 Akhil = $\emptyset 1$
 Mohith = $\emptyset 1$
 Rajesh = $\emptyset 1$
 Abhinav = $\emptyset 1 \times 3$
 Anura = $\emptyset 1$
 Vignesh = $\emptyset 1 \times 2$
 George = $\emptyset 1$
 Ahmed = $\emptyset 1 \times 3$
 Suresh = $\emptyset 1$
 Julia = $\emptyset 1$



Vignesh, saw Vignesh before so 2.

(Refer Slide Time: 5:21)

SV Stores		Ahmed 29			
Item	Category	Qty	Price	Cost	
Chocolates	Packed/Food	1	10	10	
Curd	Dairy/Food	2	32	64	
Bananas	Fruits/Food	4	8	32	
					106

Judeep = $\emptyset 1$
 Akhaya = $\emptyset 1 \times 3$
 Advait = $\emptyset 1 \times 3$
 Akhil = $\emptyset 1$
 Mohith = $\emptyset 1$
 Rajesh = $\emptyset 1$
 Abhinav = $\emptyset 1 \times 3$
 Anura = $\emptyset 1$
 Vignesh = $\emptyset 1 \times 2$
 George = $\emptyset 1$
 Ahmed = $\emptyset 1 \times 3 \times 4$
 Suresh = $\emptyset 1$
 Julia = $\emptyset 1$



Ahmed is on 4.

(Refer Slide Time: 5:26)

Big Bazaar		Radha 30		
Item	Category	Qty	Price	Cost
Broccoli	Vegetables/Food	0.5	120	60
Chicken Legs	Meat/Food	0.5	320	160
Basa Fish	Meat/Food	1	350	350
Lettuce	Vegetables/Food	0.8	150	120
Eggs	Meat/Food	12	9	108
				798

Sudheep = ϕ
 Akhaya = $\phi \times 2, 3$
 Advait = $\phi \times 2, 3$
 Akhil = ϕ
 Mohith = ϕ
 Rajesh = ϕ
 Abhinav = $\phi \times 2, 3$
 Anura = ϕ
 Vignesh = $\phi \times 2$
 George = ϕ
 Ahmed = $\phi \times 2, 3, 4$
 Suresh = ϕ
 Julia = ϕ
 Radha = ϕ

Radha is new I think, so Radha is on 0 goes to 1. This is the last card in our dataset. Now, in order to get the maximum number of shopping bills for a customer what we need to do is go through these variables, the customer variables and find out the maximum. But that would involve two iterations.

(Refer Slide Time: 6:02)

It was Monday morning. Swaminathan was reluctant to open his eyes. He considered Monday specially unpleasant in the calendar. After the delicious freedom of Saturday and Sunday, it was difficult to get into the Monday mood of work and discipline. He shuddered at the very thought of school: that dismal yellow building, the fire-eyed Vedanayagam, his class-teacher, and the Head Master with his thin long cane....

Max-frequency 3

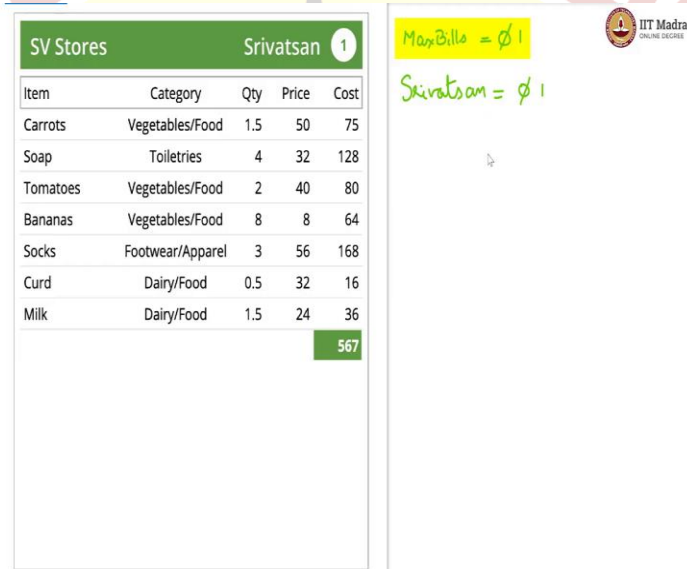
It	2	specially	1
was	3	unpleasant	1
Monday	2	in	1
morning	1	the	2
Swaminathan	1	calendar	1
reluctant	1	After	1
to	1	delicious	1
open	1	freedom	1
his	1	of	1
eyes	1	Saturday	1
He	1	and	1
considered	1	Sunday	1

Instead if you look at what the professor had done in the lecture, he declared a variable called max frequency which he kept at 0 which we initialized to 0 and each time the frequency of any

variable is greater than max frequency, max frequency was also updated to that new frequency, so it is 1 now and these are all 1's.

And now was becomes 2, so the max frequency is also updated to 2. And again was becomes 3 so max frequency is now updated to 3. So, in this way, in one iteration itself by keeping an extra variable called max frequency we get the max frequency at the end of a single iteration. Let us do the same thing with our shopping bill dataset.

(Refer Slide Time: 7:04)



The screenshot shows a presentation slide with a shopping bill dataset table and handwritten notes. The table is titled 'SV Stores' and 'Srivatsan 1'. The notes on the right state 'MaxBills = 0' and 'Srivatsan = 0'.

Item	Category	Qty	Price	Cost
Carrots	Vegetables/Food	1.5	50	75
Soap	Toiletries	4	32	128
Tomatoes	Vegetables/Food	2	40	80
Bananas	Vegetables/Food	8	8	64
Socks	Footwear/Apparel	3	56	168
Curd	Dairy/Food	0.5	32	16
Milk	Dairy/Food	1.5	24	36

567

MaxBills = 0
Srivatsan = 0

So, we have one variable which is max bills which is initialized to 0 and from there on we go through every card I am doing the same procedure as before. So, we start with Srivatsan, Srivatsan is initialized to 0 and because there is one card now, Srivatsan is incremented to 1. And now max bills 0 is less than 1, so max bills needs to be updated, we go from 0 to 1.

(Refer Slide Time: 7:43)

Big Bazaar		Sudeep 2			
Item	Category	Qty	Price	Cost	
Baked Beans	Canned/Food	1	125	125	
Chicken Wings	Meat/Food	0.5	600	300	
Cocoa powder	Canned/Food	1	160	160	
Capsicum	Vegetables/Food	0.8	180	144	
Tie	Apparel	2	390	780	
Clips	Household	0.5	32	16	
				1525	

Max Bills = ϕ 1
Srivatsam = ϕ 1
Sudeep = ϕ 1

Then we have Sudeep, who also gives us 1 no improvement in max bills.

(Refer Slide Time: 7:49)

SV Stores		Akshaya 3			
Item	Category	Qty	Price	Cost	
Face Wash	Toiletries	1	89	89	
Shampoo	Toiletries	1	140	140	
Onions	Vegetables/Food	1	98	98	
Bananas	Fruits/Food	4	8	32	
Milk	Dairy/Food	1	24	24	
Biscuits	Packed/Food	2	22	44	
Maggi	Packed/Food	1	85	85	
Horlicks	Packed/Food	1	270	270	
Chips	Packed/Food	1	20	20	
Chocolates	Packed/Food	4	10	40	
Cereal	Packed/Food	1	220	220	
Handwash	Toiletries	1	139	139	
Air freshener	Toiletries	2	70	140	
				1341	

Max Bills = ϕ 1
Srivatsam = ϕ 1
Sudeep = ϕ 1
Akshaya = ϕ 1

Akshaya 1 again.

(Refer Slide Time: 7:55)

SV Stores					Advaith 4
Item	Category	Qty	Price	Cost	
Milk	Dairy/Food	2	24	48	
Bread	Packed/Food	1	30	30	
Eggs	Food	1	45	45	
				123	

MaxBills = ϕ 1
Srivatsam = ϕ 1
Sudeep = ϕ 1
Akshaya = ϕ 1
Advaith = ϕ 1

Advaith 1 again.

(Refer Slide Time: 8:01)

Big Bazaar					Akshaya 5
Item	Category	Qty	Price	Cost	
Trousers	Women/Apparel	2	870	1740	
Shirts	Women/Apparel	1	1350	1350	
Detergent	Household	0.5	270	135	
Tee shirts	Women/Apparel	4	220	880	
Instant Noodles	Canned/Food	3	23	69	
				4174	

MaxBills = ϕ 2
Srivatsam = ϕ 1
Sudeep = ϕ 1
Akshaya = ϕ 2
Advaith = ϕ 1

And now there is one more Akshaya, so akshaya becomes 2, 2 is greater than our max bills value, so max bills needs to be updated to 2.

(Refer Slide Time: 8:11)

Sun General					6
Item	Category	Qty	Price	Cost	
Batteries	Utilities	6	14	84	
USB Cable	Electronics	1	85	85	
Ball Pens	Stationery	5	12	60	
Onions	Vegetables/Food	1.25	100	125	
				354	

MaxBills = $\phi \times 2$

Shrivasan = $\phi \times 2$

Sudheep = $\phi \times 1$

Akhaya = $\phi \times 2$

Adwait = $\phi \times 1$

Then one more Shrivasan, Shrivasan is now on 2, max bills is the same as 2 therefore we do not need to update.

(Refer Slide Time: 8:20)

SV Stores					7
Item	Category	Qty	Price	Cost	
Bread	Packed/Food	1	30	30	
Biscuits	Packed/Food	3	22	66	
				96	

MaxBills = $\phi \times 2$

Shrivasan = $\phi \times 2$

Sudheep = $\phi \times 1$

Akhaya = $\phi \times 2$

Adwait = $\phi \times 1$

Akhil = $\phi \times 1$

Akhil is new, so it is 1.

(Refer Slide Time: 8:29)

Big Bazaar					Advaith 8
Item	Category	Qty	Price	Cost	
Trousers	Men/Apparel	2	950	1900	
Basa Fish	Meat/Food	1	350	350	
Boxers	Men/Apparel	4	160	640	
Face Wash	Toiletries	1	72	72	
Slippers	Footwear/Apparel	1	170	170	
					3132

Max Bills = $\phi \times 2$

Srivatsam = $\phi \times 2$

Sudeep = ϕ

Akhaya = $\phi \times 2$

Advaith = $\phi \times 2$

Akshil = ϕ

Advaith is now on 2, max bills is also 2, so no updating.

(Refer Slide Time: 8:34)

Big Bazaar					Mohith 9
Item	Category	Qty	Price	Cost	
Lindt	Chocolate/Food	1	125	125	
Socks	Footwear/Apparel	1	120	120	
Spring Onions	Vegetables/Food	0.5	220	110	
Lettuce	Vegetables/Food	0.6	150	90	
Cookies	Snacks/Food	2	75	150	
					595

Max Bills = $\phi \times 2$

Srivatsam = $\phi \times 2$

Sudeep = ϕ

Akhaya = $\phi \times 2$

Advaith = $\phi \times 2$

Akshil = ϕ

Mohith = ϕ

Mohit is new.

(Refer Slide Time: 8:43)

Sun General					Rajesh 10
Item	Category	Qty	Price	Cost	
Notebooks	Stationery	3	20	60	
Apples	Fruits/Food	6	24	144	
Pears	Fruits/Food	4	30	120	
Chart Paper	Stationery	2	22	44	
Ruler	Stationery	1	10	10	
				378	

MaxBillo = $\phi \times 2$

Srivatsam = $\phi \times 2$

Sudeep = ϕ

Akhaya = $\phi \times 2$

Adwait = $\phi \times 2$

Alkil = ϕ

Mohith = ϕ

Rajesh = ϕ

Rajesh is also new.

(Refer Slide Time: 8:49)

SV Stores					Abhinav 11
Item	Category	Qty	Price	Cost	
Chocolates	Packed/Food	1	10	10	
Cereal	Packed/Food	1	220	220	
Bananas	Fruits/Food	6	8	48	
Tomatoes	Vegetables/Food	1	40	40	
Curd	Dairy/Food	1	32	32	
Milk	Dairy/Food	2	24	48	
Horlicks	Packed/Food	1	270	270	
Plates	Household	4	45	180	
Eggs	Food	1	45	45	
				893	

MaxBillo = $\phi \times 2$

Srivatsam = $\phi \times 2$

Sudeep = ϕ

Akhaya = $\phi \times 2$

Adwait = $\phi \times 2$

Alkil = ϕ

Mohith = ϕ

Rajesh = ϕ

Abhinav = ϕ

Abhinav is new.

(Refer Slide Time: 8:57)

Sun General					Aparna 12
Item	Category	Qty	Price	Cost	
Mosquito Coil	Household	2	24	48	
Bananas	Fruits/Food	6	5	30	
Ball Pens	Stationery	4	12	48	
Paper Clips	Stationery	1	60	60	
				186	

MaxBills = $\phi \times 2$

Sivatsam = $\phi \times 2$
 Sudeep = $\phi \times 1$
 Akhaya = $\phi \times 2$
 Advait = $\phi \times 2$
 Akhil = $\phi \times 1$
 Mohit = $\phi \times 1$
 Rajesh = $\phi \times 1$
 Abhinav = $\phi \times 1$
 Aparna = $\phi \times 1$

Aparna is new.

(Refer Slide Time: 9:04)

Big Bazaar					Abhinav 13
Item	Category	Qty	Price	Cost	
Shoes	Footwear/Apparel	1	2700	2700	
Polish	Footwear/Apparel	1	120	120	
Socks	Footwear/Apparel	2	120	240	
				3060	

MaxBills = $\phi \times 2$

Sivatsam = $\phi \times 2$
 Sudeep = $\phi \times 1$
 Akhaya = $\phi \times 2$
 Advait = $\phi \times 2$
 Akhil = $\phi \times 1$
 Mohit = $\phi \times 1$
 Rajesh = $\phi \times 1$
 Abhinav = $\phi \times 2$
 Aparna = $\phi \times 1$

Abhinav is now on 2 max bills, two is the same as 2, therefore no updating.

(Refer Slide Time: 9:09)

Sun General					Vignesh 14
Item	Category	Qty	Price	Cost	
Phone Charger	Utilities	1	230	230	
Razor Blades	Grooming	1	12	12	
Razor	Grooming	1	45	45	
Shaving Lotion	Grooming	0.8	180	144	
Earphones	Electronics	1	210	210	
Pencils	Stationery	3	5	15	
					656

MaxBills = $\phi \times 2$

Srivatsam = $\phi \times 2$

Sudeep = ϕ

Akhaya = $\phi \times 2$

Adwait = $\phi \times 2$

Alkil = ϕ

Mohith = ϕ

Rajesh = ϕ

Abhinav = $\phi \times 2$

Aruna = ϕ

Vignesh = ϕ

Vignesh is on 1.

(Refer Slide Time: 9:16)

Sun General					Abhinav 15
Item	Category	Qty	Price	Cost	
Keyboard	Toiletries	1	89	89	
Mouse	Toiletries	1	140	140	
					229

MaxBills = $\phi \times 3$

Srivatsam = $\phi \times 2$

Sudeep = ϕ

Akhaya = $\phi \times 2$

Adwait = $\phi \times 2$

Alkil = ϕ

Mohith = ϕ

Rajesh = ϕ

Abhinav = $\phi \times 3$

Aruna = ϕ

Vignesh = ϕ

One more Abhinav, so Abhinav is now on 3, 3 is greater than or max bills value 2, therefore max bills is updated to 3.

(Refer Slide Time: 9:26)

Sun General					Advaith 16
Item	Category	Qty	Price	Cost	
Pencils	Stationery	2	5	10	
Notebooks	Stationery	4	20	80	
Geometry Box	Stationery	1	72	72	
Graph Book	Stationery	1	25	25	
					187

MaxBillo = $\phi \times 3$

Srivatsam = $\phi \times 2$
Sudeep = ϕ
Akshaya = $\phi \times 2$
Advaith = $\phi \times 3$
Akshil = ϕ
Mohith = ϕ
Rajesh = ϕ
Abhinav = $\phi \times 3$
Aparna = ϕ
Vignesh = ϕ

Advaith is also on 3.

(Refer Slide Time: 9:31)

SV Stores					George 17
Item	Category	Qty	Price	Cost	
Cereal	Packed/Food	1	220	220	
Milk	Dairy/Food	1	24	24	
Cupcakes	Packed/Food	1	25	25	
Chocolates	Packed/Food	1	10	10	
					279

MaxBillo = $\phi \times 3$

Srivatsam = $\phi \times 2$
Sudeep = ϕ
Akshaya = $\phi \times 2$
Advaith = $\phi \times 3$
Akshil = ϕ
Mohith = ϕ
Rajesh = ϕ
Abhinav = $\phi \times 3$
Aparna = ϕ
Vignesh = ϕ
George = ϕ

George is new so 1.

(Refer Slide Time: 9:38)

SV Stores Ahmed 18				
Item	Category	Qty	Price	Cost
Tomatoes	Vegetables/Food	1	40	40
Curd	Dairy/Food	1	32	32
Cupcakes	Packed/Food	2	25	50
Carrots	Vegetables/Food	1.5	50	75
Beans	Vegetables/Food	1	45	45
Onions	Vegetables/Food	0.5	98	49
Turmeric	Packed/Food	1	82	82
Ghee	Packed/Food	1	230	230
				603

MaxBillo = $\phi \times 3$

Sivatsam = $\phi \times 2$
Sudheep = ϕ
Akshaya = $\phi \times 2$
Adwait = $\phi \times 3$
Akil = ϕ
Mohith = ϕ
Rishabh = ϕ
Abhinav = $\phi \times 3$
Aruna = ϕ
Vignesh = ϕ
George = ϕ
Ahmed = ϕ

Ahmed is new so 1 again.

(Refer Slide Time: 9:45)

SV Stores Neeraja 19				
Item	Category	Qty	Price	Cost
Carrots	Vegetables/Food	1	50	50
Horlicks	Packed/Food	1	270	270
Chips	Packed/Food	1	20	20
Kajal	Cosmetics	1	180	180
Milk	Dairy/Food	3	24	72
				592

MaxBillo = $\phi \times 3$

Sivatsam = $\phi \times 2$
Sudheep = ϕ
Akshaya = $\phi \times 2$
Adwait = $\phi \times 3$
Akil = ϕ
Mohith = ϕ
Rishabh = ϕ
Abhinav = $\phi \times 3$
Aruna = ϕ
Vignesh = ϕ
George = ϕ
Ahmed = ϕ
Neeraja = ϕ

Neeraja is also new, 1 again.

(Refer Slide Time: 9:55)

SV Stores				
Ahmed				20
Item	Category	Qty	Price	Cost
Tomatoes	Vegetables/Food	2	40	80
Curd	Dairy/Food	2	32	64
Cupcakes	Packed/Food	3	25	75
Carrots	Vegetables/Food	0.5	50	25
Onions	Vegetables/Food	1	98	98
Handwash	Toiletries	1	139	139
Bananas	Fruits/Food	12	8	96
Eggs	Food	1	45	45
				622

MaxBills = $\phi \times 3$

Sairatsam = $\phi \times 2$

Sudeep = ϕ

Akhaya = $\phi \times 2$

Adwait = $\phi \times 3$

Alkil = ϕ

Mohith = ϕ

Rajesh = ϕ

Abhinav = $\phi \times 3$

Aruna = ϕ

Vignesh = ϕ

George = ϕ

Ahmed = $\phi \times 2$

Neeraja = ϕ

Ahmed one more 2. Max is 3 so we do not update.

(Refer Slide Time: 9:59)

SV Stores				
Akshaya				21
Item	Category	Qty	Price	Cost
Curd	Dairy/Food	0.5	32	16
Butter	Dairy/Food	0.2	320	64
Milk	Dairy/Food	2	24	48
				128

MaxBills = $\phi \times 3$

Sairatsam = $\phi \times 2$

Sudeep = ϕ

Akhaya = $\phi \times 3$

Adwait = $\phi \times 3$

Alkil = ϕ

Mohith = ϕ

Rajesh = ϕ

Abhinav = $\phi \times 3$

Aruna = ϕ

Vignesh = ϕ

George = ϕ

Ahmed = $\phi \times 2$

Neeraja = ϕ

Akshaya is also on 3, max is the same as 3, so we do not update.

(Refer Slide Time: 10:05)

Sun General Suresh 22				
Item	Category	Qty	Price	Cost
Batteries	Utilities	2	14	28
Tomatoes	Vegetables/Food	1.5	80	120
Spinach	Vegetables/Food	1	15	15
Bananas	Fruits/Food	4	5	20
Mosquito coils	Household	1	24	24
Guava	Fruits/Food	0.4	120	48
Potato	Vegetables/Food	1.5	40	60
				315

ManBillo = $\phi \times 3$

Saivatsam = $\phi \times 2$

Sudeep = ϕ

Akhaya = $\phi \times 3$

Adwait = $\phi \times 3$

Alil = ϕ

Mohith = ϕ

Rajesh = ϕ

Abhinav = $\phi \times 3$

Aparna = ϕ

Vignesh = ϕ

George = ϕ

Ahmed = $\phi \times 2$

Neeraja = ϕ

Suresh = ϕ

Suresh is new, so only 1.

(Refer Slide Time: 10:11)

SV Stores Julia 23				
Item	Category	Qty	Price	Cost
Carrots	Vegetables/Food	1.5	50	75
Bananas	Fruits/Food	12	8	96
Curd	Dairy/Food	3	32	96
Milk	Dairy/Food	4	24	96
Cereal	Packed/Food	2	220	440
Maggi	Packed/Food	1	85	85
				888

Saivatsam = $\phi \times 2$

Sudeep = ϕ

Akhaya = $\phi \times 3$

Adwait = $\phi \times 3$

Alil = ϕ

Mohith = ϕ

Rajesh = ϕ

Abhinav = $\phi \times 3$

Aparna = ϕ

Vignesh = ϕ

George = ϕ

Ahmed = $\phi \times 2$

Neeraja = ϕ

Suresh = ϕ

Julia = ϕ

Julia is new, so only 1.

(Refer Slide Time: 10:21)

SV Stores					Neeraja	24
Item	Category	Qty	Price	Cost		
Milk	Dairy/Food	3	24	72		
Chips	Packed/Food	1	20	20		
					92	

Srivatsam = $\phi \times 2$
Sudeep = ϕ
Abhinav = $\phi \times 2 \times 3$
Adwait = $\phi \times 2 \times 3$
Akil = ϕ
Mohith = ϕ
Rajesh = ϕ
Abhinav = $\phi \times 2 \times 3$
Aparna = ϕ
Vignesh = ϕ
George = ϕ
Ahmed = $\phi \times 2$
Neeraja = $\phi \times 2$
Suresh = ϕ
Julia = ϕ

Neeraja one more 2.

(Refer Slide Time: 10:25)

Sun General					Ahmed	25
Item	Category	Qty	Price	Cost		
Earphones	Electronics	1	210	210		
Phone cover	Accessories	1	140	140		
Dongle	Electronics	1	790	790		
A4 sheets	Stationery	200	1	200		
Ball Pens	Stationery	2	12	24		
					1364	

Srivatsam = $\phi \times 2$
Sudeep = ϕ
Abhinav = $\phi \times 2 \times 3$
Adwait = $\phi \times 2 \times 3$
Akil = ϕ
Mohith = ϕ
Rajesh = ϕ
Abhinav = $\phi \times 2 \times 3$
Aparna = ϕ
Vignesh = ϕ
George = ϕ
Ahmed = $\phi \times 2 \times 3$
Neeraja = $\phi \times 2$
Suresh = ϕ
Julia = ϕ

Ahmed is on 3.

(Refer Slide Time: 10:30)

SV Stores		Srivatsan 26		
Item	Category	Qty	Price	Cost
Beans	Vegetables/Food	1	45	45
Bread	Packed/Food	1	30	30
Onions	Vegetables/Food	0.5	98	49
Bananas	Fruits/Food	6	8	48
Curd	Dairy/Food	1	32	32
Milk	Dairy/Food	3	24	72
				276

MaxBills = $\phi \times 3$
 Srivatsan = $\phi \times 3$
 Sudeep = ϕ
 Akhaya = $\phi \times 3$
 Adwait = $\phi \times 3$
 Akhil = ϕ
 Mohit = ϕ
 Rajesh = ϕ
 Abhinav = $\phi \times 3$
 Aparna = ϕ
 Vignesh = ϕ
 George = ϕ
 Ahmed = $\phi \times 3$
 Neeraj = $\phi \times 2$
 Suresh = ϕ
 Julia = ϕ

Srivatsan is also on 3, max bills is still 3, so there is no updating happening.

(Refer Slide Time: 10:39)

Sun General		Srivatsan 27		
Item	Category	Qty	Price	Cost
Broom	Household	1	70	70
Dustpan	Household	1	45	45
Floor Cleaner	Household	1	125	125
Tissue Paper	Household	2	50	100
				340

MaxBills = $\phi \times 4$
 Srivatsan = $\phi \times 4$
 Sudeep = ϕ
 Akhaya = $\phi \times 3$
 Adwait = $\phi \times 3$
 Akhil = ϕ
 Mohit = ϕ
 Rajesh = ϕ
 Abhinav = $\phi \times 3$
 Aparna = ϕ
 Vignesh = ϕ
 George = ϕ
 Ahmed = $\phi \times 3$
 Neeraj = $\phi \times 2$
 Suresh = ϕ
 Julia = ϕ

Now, Srivatsan goes to 4, max bills is less than 4 therefore update to 4.

(Refer Slide Time: 10:46)

SV Stores Vignesh 28				
Item	Category	Qty	Price	Cost
Face Wash	Toiletries	1	89	89
Shampoo	Toiletries	1	140	140
Maggi	Packed/Food	1	85	85
Chips	Packed/Food	1	20	20
Chocolates	Packed/Food	4	10	40
Air Freshener	Toiletries	2	70	140
				514

MaxBills = $\phi 1 \times 4$
 Srivatsam = $\phi 1 \times 4$
 Sudeep = $\phi 1$
 Akhaya = $\phi 1 \times 3$
 Adwait = $\phi 1 \times 3$
 Akhil = $\phi 1$
 Mohit = $\phi 1$
 Rajesh = $\phi 1$
 Abhinav = $\phi 1 \times 3$
 Aparna = $\phi 1$
 Vignesh = $\phi 1 \times 2$
 George = $\phi 1$
 Ahmed = $\phi 1 \times 3$
 Neeraj = $\phi 1 \times 2$
 Surish = $\phi 1$
 Julia = $\phi 1$

Vignesh is on 2.

(Refer Slide Time: 10:50)

SV Stores Ahmed 29				
Item	Category	Qty	Price	Cost
Chocolates	Packed/Food	1	10	10
Curd	Dairy/Food	2	32	64
Bananas	Fruits/Food	4	8	32
				106

MaxBills = $\phi 1 \times 4$
 Srivatsam = $\phi 1 \times 4$
 Sudeep = $\phi 1$
 Akhaya = $\phi 1 \times 3$
 Adwait = $\phi 1 \times 3$
 Akhil = $\phi 1$
 Mohit = $\phi 1$
 Rajesh = $\phi 1$
 Abhinav = $\phi 1 \times 3$
 Aparna = $\phi 1$
 Vignesh = $\phi 1 \times 2$
 George = $\phi 1$
 Ahmed = $\phi 1 \times 4$
 Neeraj = $\phi 1 \times 2$
 Surish = $\phi 1$
 Julia = $\phi 1$

Ahmed also goes to 4, however max bills is already 4, so no need to update.

(Refer Slide Time: 10:58)

Big Bazaar					Radha	30
Item	Category	Qty	Price	Cost		
Broccoli	Vegetables/Food	0.5	120	60		
Chicken Legs	Meat/Food	0.5	320	160		
Basa Fish	Meat/Food	1	350	350		
Lettuce	Vegetables/Food	0.8	150	120		
Eggs	Meat/Food	12	9	108		
						798

Radha's bills = $\phi \times 1 \times 4$
Sudheep = $\phi 1$
Akshaya = $\phi \times 2 \times 3$
Adwait = $\phi \times 1 \times 3$
Akshat = $\phi 1$
Mohith = $\phi 1$
Rajesh = $\phi 1$
Abhinav = $\phi \times 1 \times 3$
Aparna = $\phi 1$
Vignesh = $\phi \times 1 \times 2$
George = $\phi 1$
Ahmed = $\phi \times 1 \times 2 \times 4$
Naveen = $\phi \times 1 \times 2$
Suresh = $\phi 1$
Julia = $\phi 1$
Radha = $\phi 1$

Radha is new, so 1 and this is our last bill. Therefore, max bills is 4 and we got this in one iteration, we know that the maximum number of bills a customer has in this dataset is 4.