



IIT Madras

ONLINE DEGREE

Computational Thinking
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Local operations and max in single iteration
Part 3

Professor. Madhavan Mukund: So, there is one dataset we have not really looked at very much. So, let us try and look at that.

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Item	Category	Qty	Price	Cost
Carrots	Vegetables/Fruit	1.5	50	75
Spinach	Vegetables	1	12	128
Tomatoes	Vegetables/Fruit	2	40	80
Bananas	Vegetables/Fruit	8	8	64
Apples	Fruit	8	24	192
Onions	Vegetables	1.5	32	48
Garlic	Vegetables	1.5	24	36
Milk	Dairy/Food	1.5	24	36

So, we have these shopping bills from different shops. So, maybe one thing which might be interesting is to find out which shop is doing well? Which is the most successful shop?

Professor. G. Venkatesh: Doing well is how do we define that, doing well? Well as in?

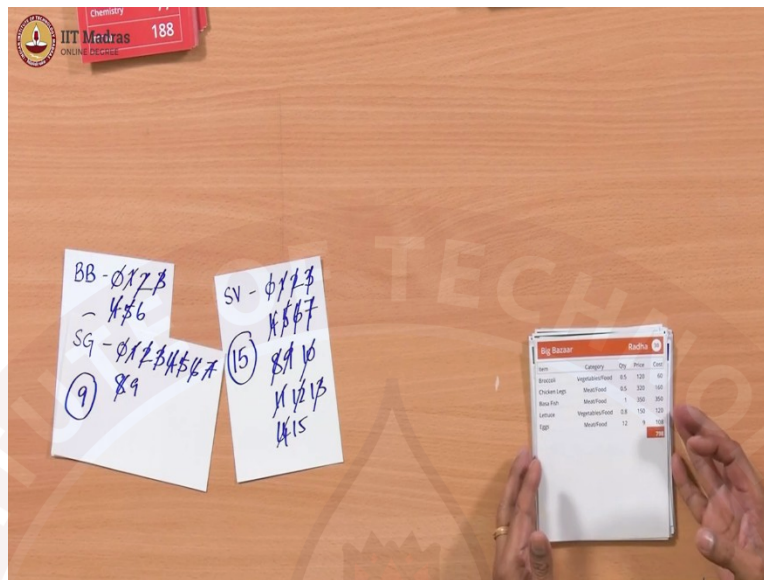
Professor. Madhavan Mukund: well, I suppose one way of measuring it is how many people go there, so how many times they actually...

Professor. G. Venkatesh: how many people go there but they may not buy anything. So, and we do not have record how many people go there.

Professor. Madhavan Mukund: Okay. So, probably how many bills...

Professor. G. Venkatesh: How many bills they generated? So, how many bills they generated? How many bills they generated? So, you want to go through that? I mean..

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Professor. Madhavan Mukund: So, now...

Professor. G. Venkatesh: We need to go through all the bill, all the all the bills here.

Professor. Madhavan Mukund: So, we are going to count bills for each shop.

Professor. G. Venkatesh: We are going to count. So, but there are many shops. We do not know how many shops there are?

Professor. Madhavan Mukund: So, we have to keep track of many counts. So, in the earlier case, when we had the marks, we were counting the number of girls and boys, we knew they are only two categories, girls and boys. Now here we do not know...

Professor. G. Venkatesh: We do not know how many stores are there to start with. We may see more stores.

Professor. Madhavan Mukund: So, what I would suggest is that we...

Professor. G. Venkatesh: Can we separate it out by store and then do it, I mean split it. So, you may get multiple piles one for each store and then, then you do the count.

Professor. Madhavan Mukund: We could do that. So, we could go through all the things once and then segregate them into different shops and then count each pile but that seems a bit

wasteful. We have to go through, I mean, there must be a way to do it in one, one single iteration.

Professor. G. Venkatesh: You can. I mean, if it looks like it should be doable in one iterate but here the problem is like, unlike what we saw earlier, we do not know how many stores there are.

Professor. Madhavan Mukund: Yes. So we have to, we have to keep a count for every store because for every store, every bill that we see, we have to add one.

Professor. G. Venkatesh: So we do not know how many stores. Are there.

Professor. Madhavan Mukund: But our problem is we do not know how many stores. So, let us just do one thing, every time we see a store, we will start a new count. So, we do not know how many count? We know that every count starts with 0 because there was no store...

Professor. G. Venkatesh: I was saying that, when we see the first store, we will do what we will start a new count.

Professor. Madhavan Mukund: So, we will keep some different counts...

Professor. G. Venkatesh: Counts.

Professor. Madhavan Mukund: We will keep one count maybe the name of the shop.

Professor. G. Venkatesh: Name of the shop. And then if we see a card and that card has a store name which is already present, then we...

Professor. Madhavan Mukund: Add 1...

Professor. G. Venkatesh: add 1 to it.

Professor. Madhavan Mukund: Yes.

Professor. G. Venkatesh: But if we see a card which has a store name which is not present, then we have to start a new count.

Professor. Madhavan Mukund: Yes, we have to start a new count.

Professor. G. Venkatesh: So, which means that we have to add one more card.

Professor. Madhavan Mukund: Correct. One more variable.

Professor. G. Venkatesh: One more variable.

Professor. Madhavan Mukund: And we will start from 0 for that variable.

Professor. G. Venkatesh: for that variable, we will start...

Professor. Madhavan Mukund: and we will we will add.

Professor. G. Venkatesh: Let us try that. Let us try that.

Professor. G. Venkatesh: So, here we are doing the same thing, iteration. We are moving the cards to a different pile. So, the first card has SV Stores on it.

Professor. Madhavan Mukund: So, this is a new card.

Professor. G. Venkatesh: new card.

Professor. Madhavan Mukund: And so let us write the name of the shop, SV so...

Professor. G. Venkatesh: you should start with something which is 0, initially 0...

Professor. G. Venkatesh: Initially 0, but we are seeing the first card...

Professor. Madhavan Mukund: so I will make it 1.

Professor. G. Venkatesh: make it 1.

Professor. G. Venkatesh: Now we have a new, new shop, shop. So, this is Big Bazaar.

Professor. Madhavan Mukund: This is not SV Stores so, I will start a new card.

Professor. G. Venkatesh: So, you start a new variable...

Professor. Madhavan Mukund: new variable.

Professor. G. Venkatesh: which is Big Bazaar which represents the count of Big Bazaar initially 0. But because we have seen Big Bazaar now.

Professor. Madhavan Mukund: I will make it 1.

Professor. G. Venkatesh: Now, we are seeing SV again.

Professor. Madhavan Mukund: So, now it is one of those we have seen, so we should take that variable...

Professor. G. Venkatesh: which is...

Professor. Madhavan Mukund: And add one to it.

Professor. G. Venkatesh: add one to it.

Professor. Madhavan Mukund: So, SV Stores is now 2.

Professor. G. Venkatesh: One more SV Stores.

Professor. Madhavan Mukund: So, now this becomes 3.

Professor. G. Venkatesh: Now, one more Big Bazaar.

Professor. Madhavan Mukund: So, this becomes 2.

Professor. G. Venkatesh: Here is another store. This is Sun General.

Professor. Madhavan Mukund: Sun General.

Professor. G. Venkatesh: Sun General. Sun General. So, we need yet another card or yet another variable. So, we are saying that more and more variables again generated actually in this.

Professor. Madhavan Mukund: Yes.

Professor. G. Venkatesh: So far in all the other things we had a fixed number of variables.

Professor. Madhavan Mukund: We knew in advance...

Professor. G. Venkatesh: how many variables.

Professor. Madhavan Mukund: how many things we needed to keep track of. Here we do not know in advance.

Professor. G. Venkatesh: we do not know. So, we are adding more variables. So, Sun General is a variable, 0 we have seen this card now. So, it will be 1.

Professor. Madhavan Mukund: So, now it is 1.

Professor. G. Venkatesh: SV Stores.

Professor. Madhavan Mukund: So, that becomes 4.

Professor. G. Venkatesh: Big Bazaar.

Professor. Madhavan Mukund: So, that becomes 3.

Professor. G. Venkatesh: Big Bazaar.

Professor. Madhavan Mukund: also 4.

Professor. G. Venkatesh: Sun General.

Professor. Madhavan Mukund: that becomes 2.

Professor. G. Venkatesh: SV Stores.

Professor. Madhavan Mukund: that becomes 5.

Professor. G. Venkatesh: Sun Sun General.

Professor. Madhavan Mukund: it is 3.

Professor. G. Venkatesh: Big Bazaar.

Professor. Madhavan Mukund: it becomes 5.

Professor. G. Venkatesh: Sun General.

Professor. Madhavan Mukund: becomes 4.

Professor. G. Venkatesh: Sun General.

Professor. Madhavan Mukund: becomes 5.

Professor. G. Venkatesh: Sun General.

Professor. Madhavan Mukund: 6.

Professor. G. Venkatesh: SV Stores.

Professor. Madhavan Mukund: 6.

Professor. G. Venkatesh: SV Stores.

Professor. Madhavan Mukund: 7.

Professor. G. Venkatesh: SV Stores.

Professor. Madhavan Mukund: 8.

Professor. G. Venkatesh: SV Stores.

Professor. Madhavan Mukund: 9.

Professor. G. Venkatesh: one more SV Stores.

Professor. Madhavan Mukund: 10.

Professor. G. Venkatesh: Sun General.

Professor. Madhavan Mukund: 7.

Professor. G. Venkatesh: SV Stores.

Professor. Madhavan Mukund: 11.

Professor. G. Venkatesh: SV Stores.

Professor. G. Venkatesh: 12.

Professor. G. Venkatesh: Sun General.

Professor. Madhavan Mukund: 8.

Professor. G. Venkatesh: SV Stores.

Professor. Madhavan Mukund: 13.

Professor. G. Venkatesh: Sun General.

Professor. Madhavan Mukund: 9.

Professor. G. Venkatesh: SV Stores.

Professor. Madhavan Mukund: 14.

Professor. G. Venkatesh: SV Stores.

Professor. Madhavan Mukund: 15.

Professor. G. Venkatesh: And then a Big Bazaar.

Professor. Madhavan Mukund: 6.

Professor. G. Venkatesh: So, according to this definition which is...

Professor. Madhavan Mukund: number of bills....

Professor. G. Venkatesh: number of bills, that is, number of people who actually bought something from the shop, number of unique purchase, purchases.

Professor. Madhavan Mukund: So, for SV Stores the total is 15.

Professor. G. Venkatesh: Total is 15.

Professor. Madhavan Mukund: For Big Bazaar, the total is 6.

Professor. G. Venkatesh: 6.

Professor. Madhavan Mukund: And for Sun General, the total is 9.

Professor. G. Venkatesh: So, if you want to find who out of these is doing the best.

Professor. Madhavan Mukund: One way is to just look at the maximum of these so...

Professor. G. Venkatesh: after you finish.

Professor. Madhavan Mukund: after you finish counting all of them, then you can count the maximum.

Professor. G. Venkatesh: One more you do because we do not know how many are there here.

Professor. Madhavan Mukund: Yes.

Professor. G. Venkatesh: We could have any number here so far we have 3, it could have been any number. So, you will go to this list again so a second iteration so, this list.

Professor. Madhavan Mukund: So, it is as though we had these three cards one on top to the other...

Professor. G. Venkatesh: and you find the maximum of these.

Professor. Madhavan Mukund: Now, this is maximum 15, 6 is smaller, move it aside, 9 is smaller, move it aside and so 15...

Professor. G. Venkatesh: 15 is highest.

Professor. Madhavan Mukund: So, this is how we would do that.

Professor. G. Venkatesh: Could we do it without having to do a second iteration through these cards? When do it in one shot. Could find the maximum without having to first generate the counts.

Professor. Madhavan Mukund: So, we could do that I guess we could keep so, we at while we are doing the cards, the counts are not yet complete. We have how many of each we seen so far. But among those we can also keep the maximum we have seen so far.

Professor. G. Venkatesh: In a new card?

Professor. Madhavan Mukund: In a new card.

Professor. G. Venkatesh: So, you keep another variable called maximum...

Professor. Madhavan Mukund: Yes.

Professor. G. Venkatesh: which keeps the maximum of these variables.

Professor. Madhavan Mukund: Yes.

Professor. G. Venkatesh: and as we go along, the maximum is keeping on getting updated with the highest value of these 3.

Professor. Madhavan Mukund: Of the any of those.

Professor. G. Venkatesh: Just like what we have done earlier.

Professor. Madhavan Mukund: Exactly.

Professor. G. Venkatesh: And at the end of it the number, maximum number will, the maximum number of all the thing.

Professor. Madhavan Mukund: All the 3 cards.

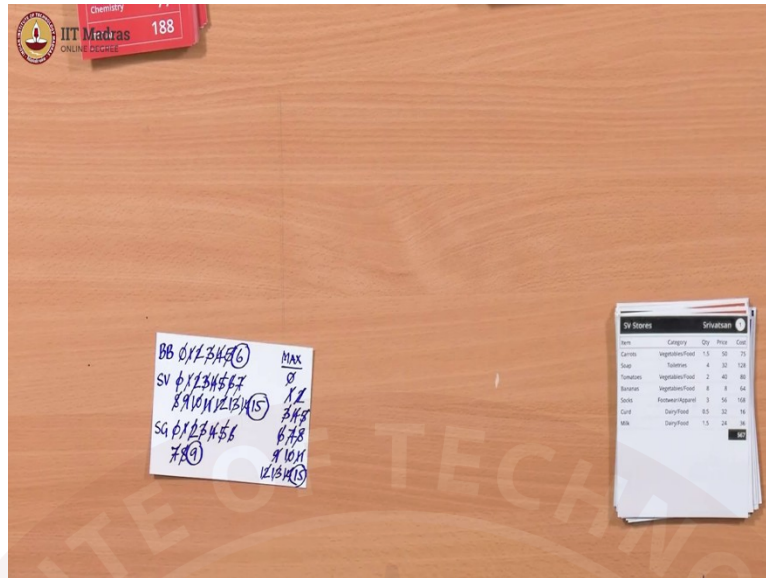
Professor. G. Venkatesh: So, that means that in one iteration, without having to do it again, we should be able to go through all these cards and find the, not only find the number of bills for each shop...

Professor. Madhavan Mukund: but also...

Professor. G. Venkatesh: but also find the maximum.

Professor. Madhavan Mukund: So should we do that?

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Professor. Madhavan Mukund: So, we will again do it so that we do not know in advance how many things there are. So, we will start, I will try to do it on one card because now I know it will fit on one card. So the first one is...

Professor. G. Venkatesh: It is in reverse order, does not matter I guess.

Professor. Madhavan Mukund: It will be in, it will be different because I do not think it should matter.

Professor. G. Venkatesh: Does not matter.

Professor. Madhavan Mukund: It is just an iteration, we are going through everything, we are just counting...

Professor. G. Venkatesh: counting.

Professor. Madhavan Mukund: We said before we can count in any order. Even the maximum in any order should be the same. So, it should not matter.

Professor. G. Venkatesh: it does not matter. So, we are going, we are going to count. So, what do we do now? We are seeing the first card which is Big Bazaar.

Professor. Madhavan Mukund: So, we have to start a count for it, start a count.

Professor. G. Venkatesh: And keep a max somewhere at the bottom, I guess.

Professor. Madhavan Mukund: somewhere we should keep a, I will keep a max on the right side.

Professor. G. Venkatesh: which you set to 0 I guess.

Professor. Madhavan Mukund: So, max should be initially 0 and we have Big Bazaar which is initially 0.

Professor. G. Venkatesh: So, we have seen Big Bazaar so, we can add 1 to it.

Professor. Madhavan Mukund: Yes, now I will make it 1.

Professor. G. Venkatesh: SV Stores.

Professor. Madhavan Mukund: so, now we start a new variable for SV and I will make it 1, when I should I should have also the max 1. So, when Big Bazaar became 1...

Professor. G. Venkatesh: max should also be 1.

Professor. Madhavan Mukund: max would becomes 1. Now SV Store becomes 1 so, I have now 1 and 1 so the max may...

Professor. G. Venkatesh: the max is 1, max has not changed.

Professor. Madhavan Mukund: this 1 is not not big.

Professor. G. Venkatesh: Max is not changed. So, another SV stores.

Professor. Madhavan Mukund: So, now SV Store becomes 2...

Professor. G. Venkatesh: and 2 is greater than max.

Professor. Madhavan Mukund: I should make the max into 2.

Professor. G. Venkatesh: Sun General.

Professor. Madhavan Mukund: so, this is a new one.

Professor. G. Venkatesh: new one.

Professor. Madhavan Mukund: So, I will keep it here, Sun General and I start with 0 and I make it one because I have seen it.

Professor. G. Venkatesh: I have seen it.

Professor. Madhavan Mukund: But the max is already 2.

Professor. G. Venkatesh: 2 so, do not update it. SV.

Professor. Madhavan Mukund: SV is 3. And now max becomes 3.

Professor. G. Venkatesh: Sun General.

Professor. Madhavan Mukund: that is 2 but the max does not change.

Professor. G. Venkatesh: SV.

Professor. Madhavan Mukund: this is now 4 and now the max is 4.

Professor. G. Venkatesh: SV.

Professor. Madhavan Mukund: So, SV is now 5. And max is also 5.

Professor. G. Venkatesh: Sun General.

Professor. Madhavan Mukund: Sun General is 3 so, the max does not change.

Professor. G. Venkatesh: SV.

Professor. Madhavan Mukund: SV is 6 and the max becomes 6.

Professor. G. Venkatesh: SV.

Professor. Madhavan Mukund: 7 and the max becomes 7.

Professor. G. Venkatesh: SV.

Professor. Madhavan Mukund: this is 8 and the max becomes 8.

Professor. G. Venkatesh: Another SV.

Professor. Madhavan Mukund: 9 and the max becomes 9.

Professor. G. Venkatesh: SV. Professor.

Madhavan Mukund: 10, the max becomes 10.

Professor. G. Venkatesh: Sun.

Professor. Madhavan Mukund: Sun goes from 3 to 4 but there is no change in the max.

Professor. G. Venkatesh: change in the max. Another Sun.

Professor. Madhavan Mukund: Sun goes from 4 to 5, no change in max.

Professor. G. Venkatesh: Another Sun.

Professor. Madhavan Mukund: Sun goes from 5 to 6, no change in max.

Professor. G. Venkatesh: Big Bazaar.

Professor. Madhavan Mukund: Big Bazaar goes from 1 to 2, no change in max.

Professor. G. Venkatesh: Sun.

Professor. Madhavan Mukund: Sun goes from 6 to 7, no change in max.

Professor. G. Venkatesh: SV.

Professor. Madhavan Mukund: SV goes from 10 to 11 and now the max goes to 11.

Professor. G. Venkatesh: Sun.

Professor. Madhavan Mukund: Sun goes from 7 to 8 and there is no change.

Professor. G. Venkatesh: Big Bazaar.

Professor. Madhavan Mukund: Big Bazaar goes from 2 to 3 and there is no change.

Professor. G. Venkatesh: Big Bazaar.

Professor. Madhavan Mukund: Big Bazaar goes from 3 to 4 and there is no change.

Professor. G. Venkatesh: SV.

Professor. Madhavan Mukund: SV goes from 11 to 12 and now the max goes from 11 to 12 also.

Professor. G. Venkatesh: Sun.

Professor. Madhavan Mukund: Sun goes from 8 to 9 and there is no change.

Professor. G. Venkatesh: Big Bazaar.

Professor. Madhavan Mukund: Big Bazaar goes from 4 to 5 and there is no change.

Professor. G. Venkatesh: SV.

Professor. Madhavan Mukund: SV goes from 12 to 13 so, that becomes a new number in the max.

Professor. G. Venkatesh: Another SV.

Professor. Madhavan Mukund: 13 becomes 14 and again this is a new number in the max.

Professor. G. Venkatesh: Big Bazaar.

Professor. Madhavan Mukund: Big Bazaar goes from 5 to 6 and SV.

Professor. G. Venkatesh: Other SV.

Professor. Madhavan Mukund: goes to 15 and the max goes to 15.

Professor. G. Venkatesh: So, we are done with all the cards. Everything is in this new pile.

Professor. Madhavan Mukund: And now we know that the Big Bazaar there was 6, SV there were 15, Sun General there were 9. So, we have these 3 counts.

Professor. G. Venkatesh: and we also have the max.

Professor. Madhavan Mukund: But interesting thing is in the same iteration without doing anything extra, we have also computed the max while we were doing this. So, in one single iteration we have kept track of the variable number of counts different counts, we did not know in advance there were 3 shops, there could have been 4 shops, 5 shops and among these variable number of shops, we have manage to keep the max while we were going along.

Professor. G. Venkatesh: So, again here we are seeing basically that we are keeping track of one max variable, an unknown number of variables, one count variable and again at each iteration we are computing, comparing the one variable with another variable.

Professor. Madhavan Mukund: So first we are filtering according to the shop name to decide which of these variables is changed...

Professor. G. Venkatesh: Which of these is changed.

Professor. Madhavan Mukund: and then we are comparing the changed variable with...

Professor. G. Venkatesh: with another variable, which is also changing variable.

Professor. Madhavan Mukund: which is also a changing variable.

Professor. G. Venkatesh: two changing variables.

Professor. Madhavan Mukund: Yes.

Professor. G. Venkatesh: we are comparing. And then keeping track of the max all the time.

Professor. Madhavan Mukund: Very good. This is interesting.