



# IIT Madras

ONLINE DEGREE

**Computational Thinking**  
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**Lecture - 4.2**  
**Concept of nested iterations using the birthday paradox (Using binning)**

So, actually I thought of an idea for this. So, we know that ah there are for instance 12 months. So, if we can first group these cards by month, so all those people born in January, all those people born in February and so on. Then, when we look for the same birthday, we only have to look within the same month. We do not have to look across months. So, by first separating.

Because we saw that you know the number of cards when we did this, the number of cards and each month was like 7, 6, 7.

Yeah.

Not too many.

Yeah because there are only thirty altogether.

Yeah.

And there are 12 months. So, they should not be. So,

So, what you are saying is that when we want to compare, it does not make sense to compare a December with a March.

Yeah.

You are doing anyway.

Exactly each time we are doing that; whereas, if we had sort of.

Get separated out.

To begin with.

So, what are you are suggesting we do; we separate the cards into bins.

Into bins; yeah so.

Bins by month.

Month of.

Which we will get 12 bins.

We will get 12 bins and then, we just have to.

Twelve bins.

Individually do this.

We could similarly, do with date but that would give you 31 bins.

Yeah correct.

Right.

And.

Now, you are doing; so but now you are doing month, which is seems more.

Yeah.

Sensible thing to do. So, you got 12 bins. So, we separate the cards into 12 bins and then, you are saying.

In each bin, we have to compare.

So, we compare cards with everything else.

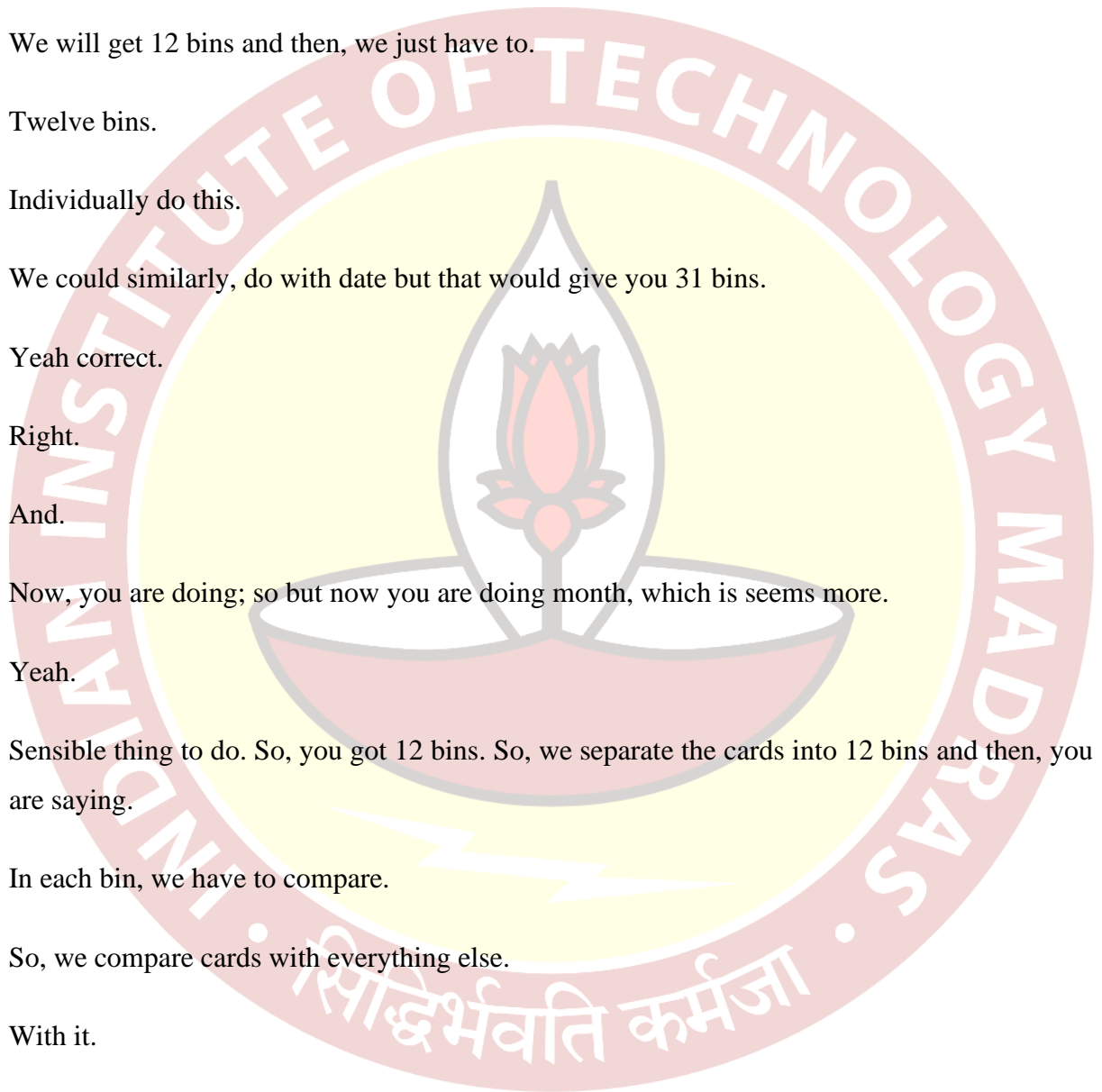
With it.

But since the number is very small.

It will be like.

6 or 7, it will be much faster.

Yeah.



So, if you do it systematically, we have to do it again like a nested iteration, but it will only be few cards, 5 cards or something. So, it will be 5 into 4, maybe 10 comparisons per bin. So, the total number of things will be much less than.

Much less than.

Than doing this 400 comparison.

Comparisons. Interesting, How did that happen? I mean suddenly, we found, it got reduced. So, this is done it.

Yeah.

So, because there is this natural categorization into.

Yeah.

Months and days.

Yeah.

We are using.

Yeah.

Taking wherever.

There are some natural groups and you expect the groups to be sort of weeks.

Distributed equally distributed.

Because everybody is born in December, then ?

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You are you know, that you have only 30 days in December so.

So, you are expecting that the group. So, basically if you divided into 10 bins or 12 bins or number of bins.

Yeah.

Expect that the number of cards are somewhat fairly equally distributed.

Yeah exactly.

So, the number of cards per bin comes down and then?

Yeah.

This business of doing.

Yeah.

Everything with everything.

Yeah.

Which is a product right, you are doing.

That becomes a lot easier.

Very interesting. Let us try that.

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The image shows a large, faint watermark of the IIT Madras logo in the background. The logo is a circular emblem with a lotus flower in the center, surrounded by the text "INSTITUTE OF TECHNOLOGY MADRAS". In the bottom left corner, there is a small IIT Madras Online Degree logo. Below this, a red student ID card is held up by a hand. The card contains the following information:

Name	Arshad	17
Gender	M	
Date of Birth	14 Dec	
Town/City	Chennai	
Mathematics	62	
Physics	81	
Chemistry	67	
TOTAL	210	

Ok. So, first do the binning. So, we will just create.

So, we have to have 6, so we know. So, let us put it in order of months. So, December let us keep it here.

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Name	Gender	Date of Birth	Town/City	Mathematics	Physics	Chemistry	TOTAL
Deepika	F	14 Jan	Chennai	52	64	71	187
Harish	M	8 Feb	Chennai	71	92	84	247
Sophia	F	30 Apr	Bengaluru	78	69	74	221
Vetrivel	M	30 Apr	Bengaluru	97	92	92	281
Harish	M	3 June	Salem	62	45	91	198
Sophia	F	23 Jul	Trichy	89	62	93	244
Vetrivel	M	30 Aug	Trichy	56	78	62	196
Kalyan	M	17 Sep	Vellore	93	68	91	252
Abirami	F	9 Oct	Erode	72	92	97	261
Bhuvanesh	M	7 Nov	Erode	68	64	78	210
Tauseef	M	30 Dec	Trichy	87	86	43	216

March, let us keep it there. Just roughly keeping the place according to the thing.

So, if you take, I mean 4, 4 per row, 3 rows ok. So, Jan, Feb, March, April right.

Ok.

March something comes here.

So.

This will be April. So, let us keep ok. May we will see ok.

So, December goes with December.

Ok.

March goes with March.

September is a new bin.

September. June comes somewhere in between.

July is here.

March goes with March; July, July; November comes near December.

November. April, we do not have yet. So, let us keep it next to that.

January, January.

Hm.

January. September, we have a bin. December we have a bin. May, let us keep it here. October, we do not have a bin yet. May, March, December, May; August, we do not have a bin, so let us keep. So, maybe June, July, August, this we complete.

And February, February, May and October right.

So, we actually.

Kind of.

Distributed yeah. We actually have at least one in each bin, one in each bin.

Yeah.

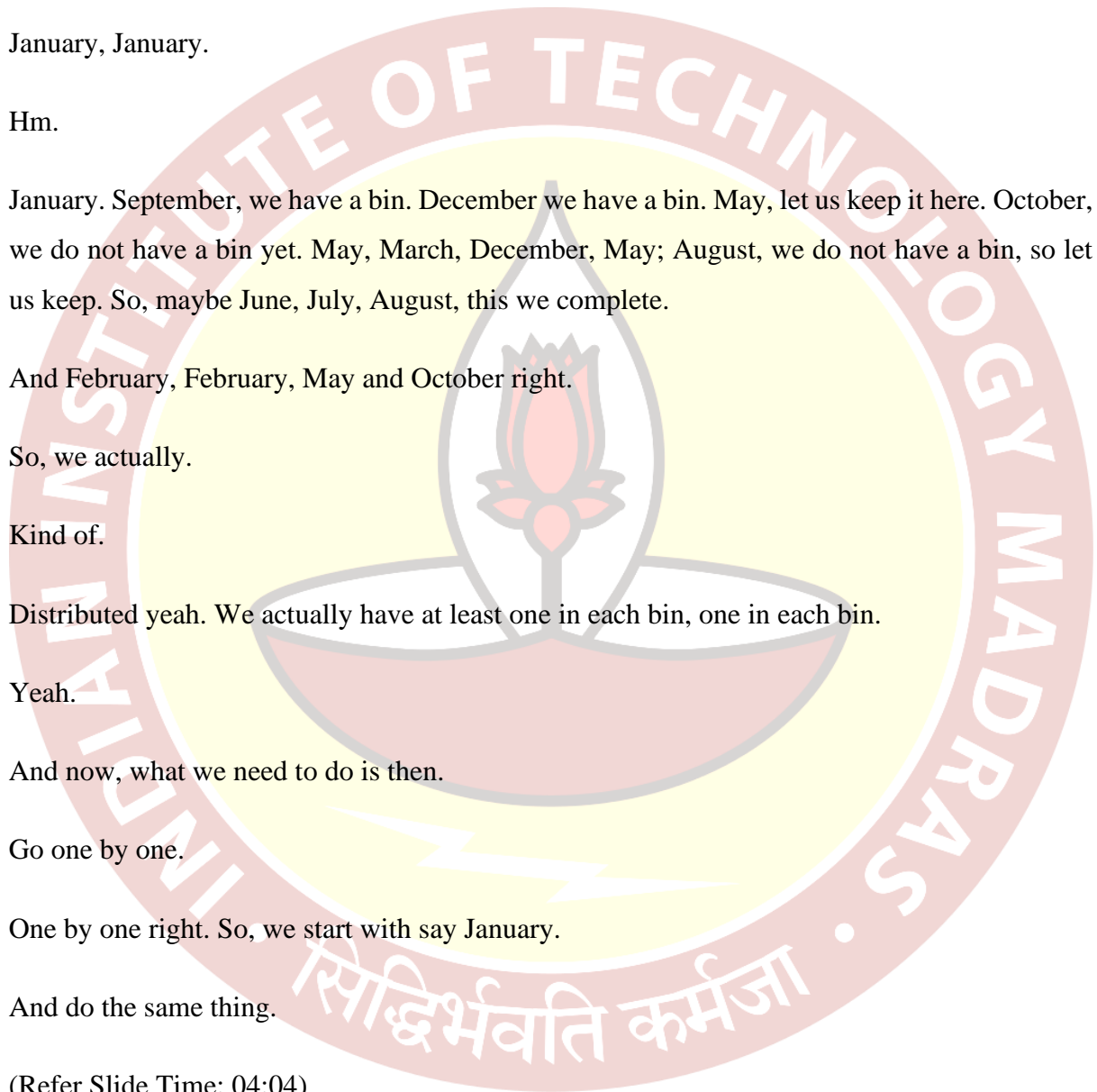
And now, what we need to do is then.

Go one by one.

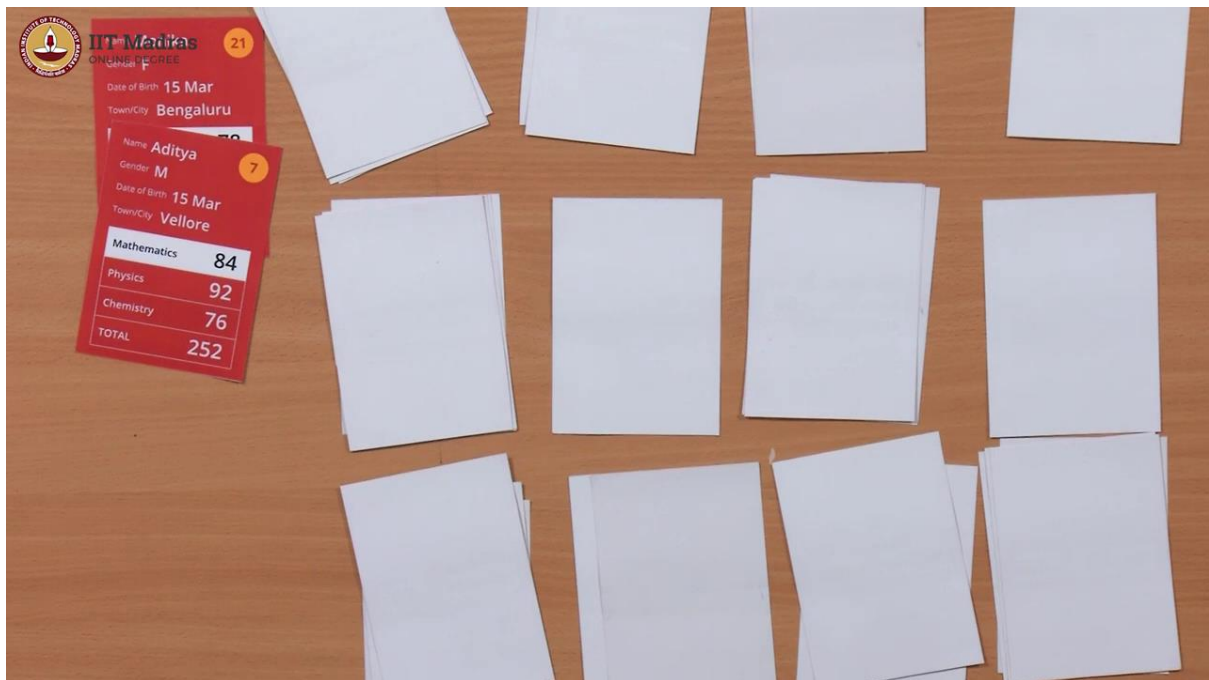
One by one right. So, we start with say January.

And do the same thing.

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Yeah, do the same thing. So, we will say try Srinidhi. So, 14 January; 4th is not there, 12th is not there. So, this is out. Then, we compare these two and now, we are done. So, January.

That as fast ah, really fast.

So, January is done. January; then maybe turn it over to say this done.

February, we have only two and they are different.

Ok.

So goes (Refer Time: 04:20) anything.

And in this case, we know that the answer comes in March [laughter]. So, we likely find it fast; 15th-15th, so we have found in March. But these two are different.

Right.

So, we have maybe we can keep these aside for now. But now, we can also do this what we said before are they.

And all the pairs.

Any other pairs?



And all the pairs.

Yeah. So, again?

All the pairs yeah. That is really cool, yeah.

So, April, there is only one. So, cannot be April.

So, now we have to May has a lot. So, we first do it systematically. So, May so we have to compare for 13. So, it is not 5, it is not 6, it is not 16. So, this is out. So, we can actually do it by inspection; but we have to do it systematically.

For 16, we say it is not 6, not 5. So, 16 is out.

Then, 5 and 6 are different. So, these are different. So, May is out.

Yeah.

This is fast. June only one. July again, we have a few. So, 23rd July, it is not 17 not 22nd and 17 and 22nd are also different from each other. So, this is out.

August only one.

September check 22 check 10. So, it is not 17 and it is not 22 and it is not 10. October only 2, they are not equal to each other. November only 2, they are not equal to each other. December there are a few, but again you can check them. So, 30th; it is not 26, not 6, not 14. So, it is not 30th.

14 is not 6, not 26; so it is not 14 and then, 6 is not bin. So, all these are different. So, we are done so actually now in much less time.

Much less time right noticeably

(Refer Time: 05:58) found.

Less time and you will not make mistakes you know, the other thing is that when you go through like this, it makes the mistakes also get reduced.

So, actually binning helped.

Binning helped.

Yeah, but we have to be a bit careful because binning of course, it need not help. For instance, there are 30 cards, they could have been.

All December.

Yeah, all December, all on different days.

Oh, yeah. It could be yeah.

Then, we would have still had to do.

Yeah.

But one expects I mean. So, you have to choose, you have to basically choose the binning method.

Yes,

In such a way that it kind of distributes the cards across the desk.

Exactly.

Then, it makes right then it starts to make sense.

Yeah exactly.

So, for instance, if it is that and we have chosen the date to bin.

Then, we would have got 30 bins with one date each.

And we would have known that there are no.

Yeah, correct correct.

So, sometimes looking at the data gives you a clue as to what would be a simpler way of organising it.

Right.

But essentially here, we did this one pass to do the binning and then, we did several very small passes to do the actual selection and.

That one pass through the bin is single iterations.

Is one single iteration.

And the several small passes, they are all technically.

Nested iterations.

Technically.

Much smaller.

Smaller smaller sense.

Some of them were only 1 or 2. So, essentially, there was no iteration; just one comparison was enough.

Yeah.

And so, for these numbers at least this worked much better; but this could also dramatically cut down the time, if we have a larger set.

Correct, correct, correct.

Yeah. So, it is useful to think ah little bit before blindly.

Before just jumping into the.

Jumping into a problem.

Problem and solving it right? Ok.

