Optimization Strategies
Lesson Plan: Class 07 / DA / 02

Overall goal of the lesson	**Evaluation and improvement of algorithms**
Prior knowledge required	Algorithms

MODULE 1: **Module time: 2 *** 35 minutes

Goal:	Evaluation and improvement of algorithm efficiency and execution
Description:	Tackle simple problem from everyday life, come up with multiple ways to solve it and compare these ways to see which one is optimal
Material required:	**Physical:** Paper, pen, the stickies from the previous lesson **Electronic:** None
Procedure Details:	1. Set the agenda by recalling 'al-go-rithm' and 'optimization' and explaining what we want to do. 2. Recall Ms Shanti's marksheet example and put up Sticky 1 on the board. Get the children to realise that the format of the sticky isn't very convenient for searching. 3. Ask the children what format they think will be easier to look up? Then introduce the tabular format. 4. Slide 5: Now ask them how Ms Shanti would prepare the report. Let them realise that deviations are not easily available. Ask them – so what do we do about that? Let them suggest – add deviations to the table. 5. Slide 6 – ask the kids to look at the table again – do we have all the information we need to generate the report for each child? 6. Slide 7 – the algorithm to generate all the reports using the table, and pre-calculated mean, deviations and mean deviation. 7. Slide 8 – principal asks for a new report! Now that we need alphabetical order, ask the children what to do first – they may suggest reorder the existing table – you can discuss pros and cons of that. 8. Slide 9, 10 & 11– the concept of an 'index' on a table is introduced. Ask the children what they would do if they wanted to sort in yet another way – say by deviations. 9. Slide 12 – Don't emphasise the formula – just say it is so. Main thing for them to realise is that it's a large number of teams, and reducing 'n' will help. 10. Slide 13, 14 & 15 – explain how we get the team options. 11. Slide 16 – introduction to factorials – this is a simple example and the children ought to be able to identify the optimization themselves! 12. Slide 19 – recap of what we learned.

ANSWERSHEET

1. The table can be completed as follows

Typist	Words per hour	Hours to complete 12000 words	Cost for total hours
Rita	15 X 60 = 900	12000/900 = 14	14X300 = Rs 4200
Anita	16 X 60 = 960	12000/960 = 12.5 → 13	13 X 360 = Rs 4680
Meena	20 X 60 = 1200	12000/1200 = 10	10 X 400 = Rs 4000

2. The other two combinations can be similarly done.

Rita & Meena – let's start with 5 hours (reuse Rita's data from first table)

Hour	Words by Rita	Words by Meena	Total Words	Total Cost
5	4500	6000	10500	700X5=3500
6	5400	7200	12600	700X6=4200

12600 words is more than 12000 so we can stop there.
Note that 12600 – 12000 = 600 so we cannot reduce the number of hours put in by either Rita or Meena.

Anita & Meena – let's start with 5 hours (reuse Anita's data from first table and Meena's data from second table)

Hour	Words by Anita	Words by Meena	Total Words	Total Cost
5	4800	6000	10800	760X5=3800
6	5760	7200	12960	760X6=4560

12960 words is more than 12000 so we can stop there.
Note that 12960 – 12000 = 960 so we cannot reduce the number of hours put in by either Anita or Meena.
Therefore, Mr X should use the combination of Rita and Meena for 6 hours to minimize the cost of typing his 12000-word manuscript.

3. Use the logic explained in the question.
In general, to select r items from n different items the formula is $rnC = \frac{n!}{r!\times(n-r)!}$
In the question, r is 3 and n is 6.
Therefore, $36C = \frac{6!}{3!\times3!} = \frac{(6\times5!)}{3!\times3\times2!)} = \frac{6}{3} \times 35C = 2\times10 = 20$

Notice that we made use of the calculation which was already done in the question!

4. Now Husain wants to use any 2 colours out of 6. So r = 2 and n = 6.
Therefore, the possible combinations are:
$26C = \frac{6!}{2!\times4!} = \frac{(6\times5!)}{(2!\times4\times3!)} = \frac{6}{4} \times 25C$

But $25C = \frac{5!}{(2!\times3!)} = \frac{5!}{(3!\times2!)} = 35C$

i.e., $25C = 35C$. Isn't that surprising! (Note: 3 = 5 – 2)

Ok, let's check $15C \; and \; 45C$ (Note: 4 = 5 – 1)

$$15C = \frac{5!}{1!\times4!} = \frac{5!}{4!\times1!} = 45C$$

So $15C = 45C$

Well! Let's check the general case then.

$$rnC = \frac{n!}{r!\times(n-r)!} = \frac{n!}{(n-r)!\times r!} = \frac{n!}{(n-r)!\times[n-(n-r)]!} = (n-r)nC$$

Thus, we find that $rnC = (n-r)nC$ for any value of n or r.

Going back to painter Hussain, $25C = 35C = 10$

So, $26C = \frac{6}{4} \times 10 = 15$

MARKSHEET - ENGLISH

ANIL - 45
RAM - 28
KUMAR - 60
ABHI - 37
ROHAN - 88
ARUN - 42
RAHUL - 12
KIRTI - 90
SITA - 55
SHALU - 64
PRITI - 72
POOJA - 39
ASHA - 80
ASHOK - 70
BHARAT - 53
KAVYA - 69
RAMANA - 77
RUHI - 60
POORVI - 19
AKSHAY - 40

STICKY 1 – SORTED MARKS

RAHUL - 12
POORVI - 19
RAM - 28
ABHI - 37
POOJA - 39
AKSHAY – 40
ARUN - 42
ANIL - 45
BHARAT - 53
SITA - 55
KUMAR - 60
RUHI - 60
SHALU - 64
KAVYA - 69
ASHOK - 70
PRITI - 72
RAMANA - 77
ASHA - 80
ROHAN - 88
KIRTI - 90

STICKY 2

Lowest score: 12
Highest score: 90
Average score: 55

STICKY 3 - DEVIATIONS

Rahul - 43
Poorvi - 36
Ram - 27
Abhi - 18
Pooja - 16
Akshay – 15
Arun - 13
Anil - 45
Bharat - 2
Sita - 0
Kumar - 5
Ruhi - 5
Shalu - 9
Kavya - 14
Ashok - 15
Priti - 17
Ramana - 22
Asha - 25
Rohan - 33
Kirti - 35