Optimization Strategies
Lesson Plan: Class 08 / DA / 01

Overall goal of the lesson	**Evaluation and improvement of algorithms**
Prior knowledge required	Algorithms, Pseudo code: assignments, for loop construct, if-the-else construct

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

Goal:	Evaluation and improvement of algorithm efficiency and execution
Description:	Tackle simple problems, come up with a way to solve it. Evaluate the cost of the method and then try to modify the algorithm to reduce the cost.
Material required:	**Physical:** Paper, pen **Electronic:** None
Procedure Details:	1. Set the agenda by recalling ‘al-go-rithm’, ‘evaluation’ and ‘optimization techniques’ and explaining what we want to do. 2. Slide 4 - Introduce the problem. There are 3 age groups in the 9th class. Given a set of marks we want to find the maximum marks in each age group. Explain the algorithm. We go thru each student, check her age and then see if she has scored more than her group’s maximum – in that case change the maximum. 3. Slide 5 – calculate the cost of the algorithm. First, let the children try to do it. They should realise on their own that they can’t, because they don’t know how many children in which age group. Then give them the additional data and let them try again. They should be able to calculate the cost. 4. Slide 6 – Can they spot which part of the algorithm is wasteful? Try to make them step through the algorithm for the different age groups to figure out. And then ask them what we can do to make it less wasteful – they should be able to guess. 5. Slide 7 – the modified algorithm 6. Slide 8 - let them re-evaluate cost for the modified algorithm. 7. Slide 9 – explain second problem. We need average size of household (mean) and commonest size of household (mode) for 4000 strong data. Revise what is mean and mode using a small set of sample data like so: 18, 10, 12, 15, 10, 14, 10, 22, 12, 16 → mean is 127/10 = 12.7 and mode is 10. Explain what is meant by ‘size of household’ – number of people living in one house. Explain what is meant by ‘census’. Let them try to write the algorithm on their own – at least for mean. 8. Slide 10 – the algorithm for mode. Explain ‘initializations’ – why we do them. 9. Slide 11 – evaluate our algorithm. They may not be able to find out what is wrong immediately, but they should be able to come up with how to fix it. 10. Slide 12 – modified algorithm 11. Slide 13 – evaluate the new algorithm – let them try and then realise they can’t do it because the data is not analysed yet! However, we can use our common sense to figure out a common family size in urban areas. 12. Slide 14 – So we modify again. 13. Slide 15 – recalculate the cost.

	14. Slide 16 – since cost is still high, introduce the idea of a list (or array) where we can use an ‘index’ into the list to directly refer to that element of the list. So can we use such a list to store size of household? Yes we can, but what about ‘more than 5’? We need to map ‘more than 5’ to a list index too. 15. Slide 17: modify the algorithm accordingly. 16. Slide 18: Re-evaluate. Let the children evaluate for the 2-3 sets of data and figure out for themselves that the cost is constant! 17. Slide 19 & 20 – explain the problem using the example. Let the children try to write the algorithm – just give them the first two lines maybe. 18. Slide 21 – let them step through the algorithm for the examples given. See if they can spot what is a waste of time as they step through. They should be able to figure it out. 19. Slide 22: See if they can come up with how to fix it else suggest the 2 possible ways. 20. Slide 23 – take them through the first option. Make sure they understand what we have done to fix the issue of unnecessary looping + comparisons. 21. Slide 24 – second option, make sure they understand the difference from the first. 22. Slide 25 – evaluate cost for both using the 2 sample strings. 23. Slide 26 – Introduce the idea of ‘ascii value’ which associates a number with a character. How can we use this feature to optimize our algorithm? See if they can figure it out. Anyway, explain mapping the character to an index. 24. Slide 27 – modified algorithm. Comparisons are completely eliminated. 25. Slide 28 – recap of what we learned.