Optimal Storage on Tapes

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- There are n programs that are to be stored on a computer tape of length L. Associated with each program i is a length L_i.

- Assume the tape is initially positioned at the front. If the programs are stored in the order $I = i_1, i_2, \ldots, i_n$, the time t_j needed to retrieve program i_j

$$t_j = \sum_{k=1}^{j} L_{i_k}$$

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- If all programs are retrieved equally often, then the mean retrieval time (MRT) = $\frac{1}{n}\sum_{j=1}^{n} t_j$
- This problem fits the ordering paradigm. Minimizing the MRT is equivalent to minimizing

$$d(I) = \sum_{j=1}^{n}\sum_{k=1}^{j} L_{i_k}$$

Example

- Let $n = 3$, $(L_1,L_2,L_3) = (5,10,3)$. 6 possible orderings. The optimal is 3,1,2

Ordering I	d(I)
1,2,3	5+5+10+5+10+3 = 38
1,3,2	5+5+3+5+3+10 = 31
2,1,3	10+10+5+10+5+3 = 43
2,3,1	10+10+3+10+3+5 = 41
3,1,2	3+3+5+3+5+10 = 29
3,2,1,	3+3+10+3+10+5 = 34

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- The greedy method is now applied to solve this problem. It requires that the programs are stored in non-decreasing order which can be done in O (nlogn) time.

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- **Greedy solution:**

i. Make tape empty

ii. For i = 1 to n do;

iii. Grab the next shortest path

iv. Put it on next tape.

- The algorithm takes the best shortest term choice without checking to see whether it is a big long term decision.

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- **Algorithm :**
  - **Arrange the programs in non decreasing order of length.**
  - **Mean retrieval time Computation:**

```
Tj=0; T=0;
for(i=0; i<n; i++)
{
for (j=0; j<i ; j++)
{
Tj = tj+ L[j];
}
}
for(i=0; i<n; i++)
T=T + Ti;
MRT =T/n
```