**Day 1 – Problem Solving and Data Structures**

**Excersise**

1. **A bear starting from the point P, walked one mile due south, Then he changed direction and walked one mile due east. Then he turned again to the left and walked one mile due north and arrived at point P he started from what was the colour of the bear?**

Algorithm to Determine the Bear's Colour

Step 1: Define the starting point P.

Step 2: Move 1 mile south from P to a new location Q.

Step 3: Move 1 mile east from Q to a new location R.

Step 4: Move 1 mile north from R back to the starting point P.

Step 5: Check if the starting point P is the same as the final position after the movements.

If true, the bear is in a special geographic location.

Step 6: Identify the only region on Earth where such a movement is possible: near the North Pole.

Step 7: Since only polar bears inhabit this region, conclude that the bear is white.

Output: "The bear is white.

**2. Two towns A and B are 3 km s apart It is proposed to build a new school serving 100 students in town A and 50 students in town B. How far from town A should the school be built if the total travel distance by all 150 students is to be as small as possible?**

Step 1 :Start with basic information:

Town A is at 0 km.

Town B is at 3 km.

There are 100 students in Town A.

There are 50 students in Town B.

Decide where to place the school:

The school can be anywhere between 0 km and 3 km.

We will check different locations in small steps (0.01 km at a time).

Step 2: Calculate total travel distance for each location:

For each possible school position, calculate how far all students have to travel.

Formula:

Total Distance =(100×Distance of school from Town A)+(50×Distance of school from Town B)

Total Distance=(100×Distance of school from Town A)+(50×Distance of school from Town B)

Find the best location:

Step 3 : Start with a very large total travel distance.

Compare each location’s total travel distance.

If a location has a smaller travel distance than the previous best, update the best location.

Stop when all locations are checked:

Step 4: The best location is the one with the smallest total travel distance.

Print or return this location.

Final Answer:

The best place to build the school is 1 km from Town A.

1. **A traveller arrives at hotel he has no money but only a silver chain consisting of 6 links. He uses one link to pay for each day spent at the hotel but the hotel manager agrees to accept no more than one broken link . How should the traveller cut up the chain in order to settle the amount with the hotel manager on a daily basis**

**i) what is the least number of links that have to be cut if the traveller stays 100 days at the hotel and has a chain cosisting of 100 links? what is the answer in general case n days and n links**

Step 1: Initialize

- Input N (number of links/days)

- Set cuts = 0

Step 2: Calculate cuts using powers of 2

- While N > 1:

- Reduce N by the largest power of 2 that fits

- Increment cuts

Step 3: Output cuts (minimum number of cuts needed)

**4. Rearrange the letters in the words new door to make one word**

Step 1: Read input "new door"

Step 2: Remove space → "newdoor"

Step 3: Generate all letter arrangements of "newdoor"

Step 4: Check if any arrangement forms a valid word

Step 5: Output the valid word → "one word"

**5. do divide and conquer 6 5 1 4 3 2**

Step 1: Divide

- Split the array into two halves until each subarray contains only one element.

- Example:

[6, 5, 1, 4, 3, 2] → [6, 5, 1] and [4, 3, 2]

[6, 5, 1] → [6] [5, 1] → [5] [1]

[4, 3, 2] → [4] [3, 2] → [3] [2]

Step 2: Conquer (Sort)

- Sort and merge smaller subarrays into larger ones:

[5] [1] → [1, 5]

[6] [1, 5] → [1, 5, 6]

[3] [2] → [2, 3]

[4] [2, 3] → [2, 3, 4]

Step 3: Merge

- Merge the two sorted halves:

[1, 5, 6] and [2, 3, 4] → [1, 2, 3, 4, 5, 6]

Step 4: Output the sorted array

- Final sorted array: [1, 2, 3, 4, 5, 6]

**6. Draw a flowchart to calculate the simple interest**

Input P, n, r

Print SI

Calculate SI = (P x n × r) / 100