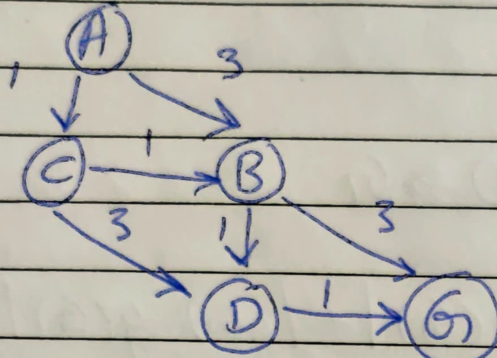
Ans 2: Given graph



a. Sequence of frontiers: (DFS)

frontier: i) [A] - start with 'A'

ii) [B, C] - Expand A, add its children B, C (alphabetically)

iii) [D, C] - Expand B, add its child D

iv) [G, C] - Expand G, goal reached.

Path found: A → B → D → G cost = 5

b. Sequence of frontiers: (BFS)

frontier [A] - start with A

[B, C] - Expand A, add B, C

[C, D] - Expand B, add D

[D, G] - Expand C, add nothing (has unexplored children)

[G] - Expand D, add G, then expand G. Goal reached

Path found :- A → B → G cost = 6

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2.d) [A(0+4)= 4] : Start at A. $g(A)=0$, $h(A)=4$ so $f(A)=0+4$ $=4$

[C (1+3 =4), B(3+2 =5)]
→ Expand A, adding its neighbors
→ For C: $g(C)=1$, $h(C)=3$, so $f(C)= 1+3=4$
→ For B: $g(B)=3$, $h(B)=2$, $f(B)= 3+2=5$

[B(2+2=4), D(4+1=5)]
→ Expand C (lowest f-value in frontier).
→ update B : g(B) through C is $1+1 =2$; $f(B)= 2+2=4$
→ add D: $g(D) = 1+3=4$, $h(D)=1$, $f(D)= 4+1=5$

[D(3+1=4), G (5+0=5)]
→ Expand B (lowest f- value in frontier).
→ update D: g(D) through B is $2+1=3$, $f(D)= 3+1=4$
→ Add G: $g(G)=2+3=5$, $h(G)= 0$, $f(G)= 5+0=5$

[G(4+0=4)]
→ Expand D (lowest f-value in frontier).
→ update G: g(G) through D is $3+1=4$, so new $f(G)= 4+0=4$.

Path → A→C →B →D→G cost = 4

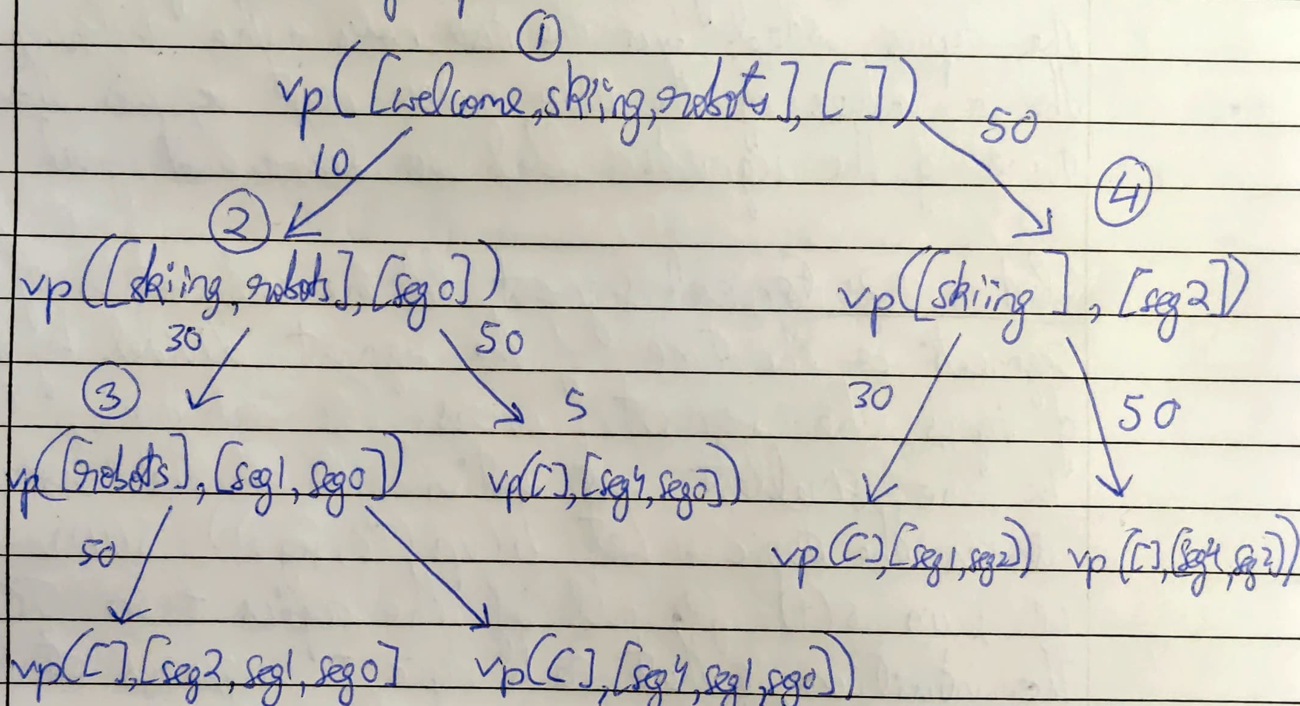
Ans 3: In this question we will investigate using graph
a) searching to design video reps.

Suppose we represent a node as the term

vp(To_Cover, segs)

segs → list of segments

To_Cover → list of topics



There are 2 solutions for

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3 b) Solution #1: For each topic, t, let $s(t)$ be the length of the smallest segment that covers topic t. Let $h(vp(TC, Segs)) = max_{t\ in TC}\ s(t)$. That is, we find the topic t for which $s(t)$ is maximum.
Yes, it satisfies the monotone restriction as the actual distance b/w any two nodes is the sum of the length of the topics added b/w the two nodes. The difference b/w the h-values of the two nodes must be less than the time of the segments added to solve that goal.

Solution #2: For each segment let the contribution of the segment be the time of the segment divided by the number of topics the segment covers. For each topic, t, let $s(t)$ be the smallest contribution for all the segments that covers the topic. Let $h(vp(TC, Segs)) = SUM_{t\ in TC}\ s(t)$
we sum $s(t)$ for all of the topics t in TC.
The intuition is that each topic t requires at least $s(t)$ time. Note that we need to divide by the no. of topics the segment covers to make sure that we don't double count the time of segments added that cover multiple topics.
Yes, it satisfies the monotone restriction (for the same as above).
Both of these solution require one pass through the segments database to build the $s(t)$ function, but once this is built, the heuristic function can be computed in time proportional to the length of the To_Cover list.

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3 c) Yes, the topic selected does affect the result. The order of topic selection can lead to diff. neighbors being generated and thus different paths in the search space. Since the goal is to minimize the total presentation time, selecting different topics can lead to shorter or longer presentations depending on the segments that cover those topics.
For instance, if the leftmost topic is always selected and a segment that covers multi topics is chosen (like seg 4 covering both skiing and robots), it reduces the remaining topics faster, leading to a more optimal solution. Conversely, selecting topics that are covered by segments if not handeled carefully. ∴, the topic segment strategy has a direct impact on the optimality of the solution found.

2.c) We start with A → [A(0)]
Expand A, adding its neighbors to the frontier
[C(1), B(3)]
cost to C = 1 ; B = 3   Lowest = C
Expand C → [B(2), D(4)]
update B's cost : reaching B through C costs 1+1=2
Expand B → [D(3), G(5)]
update D's cost : reaching D through B costs 2+1=3 < 4
Expand D → G(4)
update G's cost : reaching G through D costs 3+1=4
Final path :
A → C → B → D → G   cost = 4