# CS188 (Fall 2018)

## Introduction to Artificial Intelligence

## Homework 1

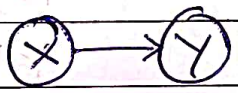
### 1. Search

⇒ Heuristic is admissible if:

$$0 \leq h(x) \leq h^*(x)$$

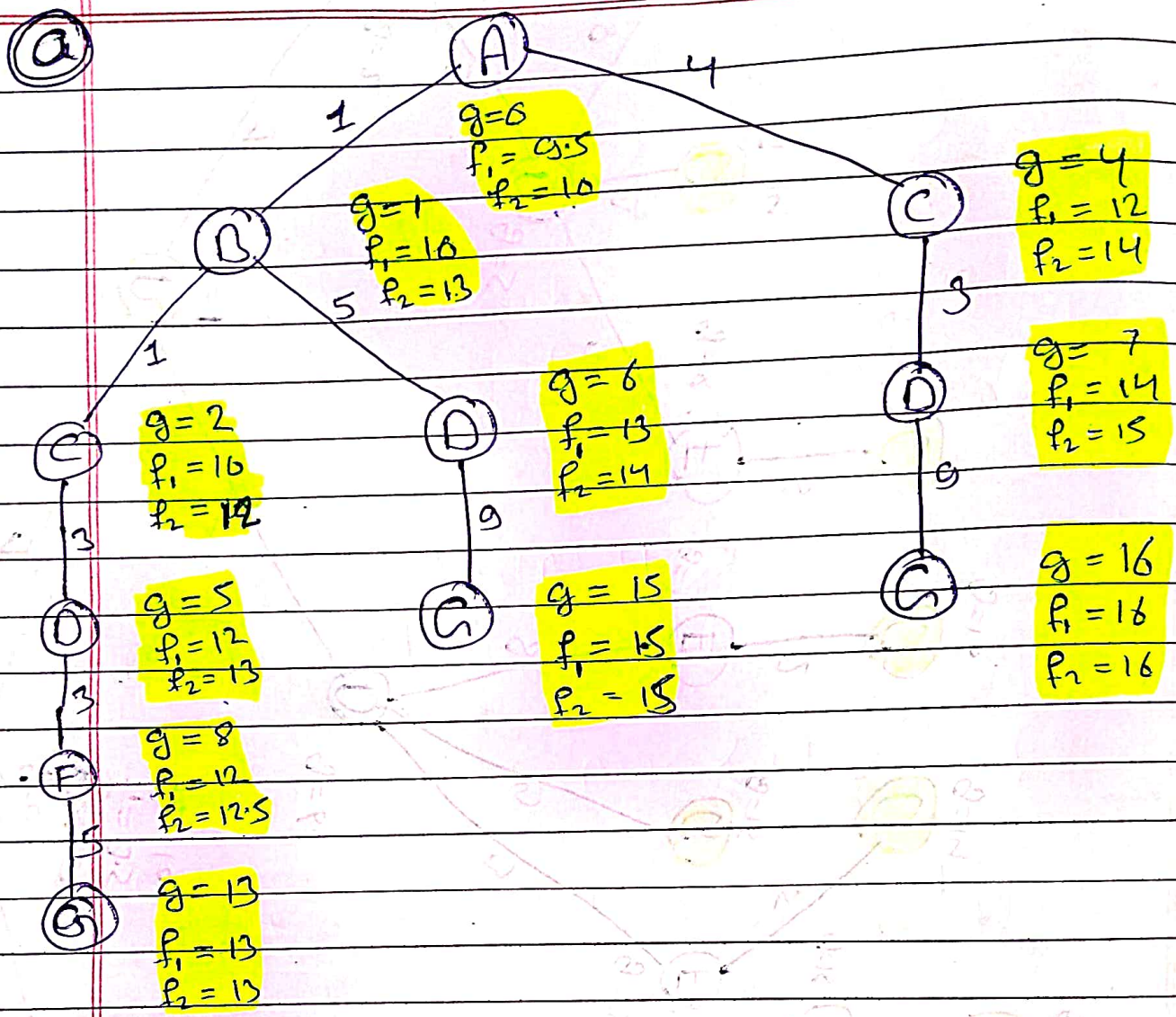
{True Cost to nearest Goal}

⇒ Heuristic is Consistent if




$$h(x) - h(y) \leq \text{Cost}(x \text{ to } y)$$

{∀ Connected states}




(i) Depth first Search

→ A-B-D-G , A-C-D-G & A-B-C-D-F-G

(ii) Breadth first

→ A-B-D-G
→ A-C-D-G

{As same chain length}

(iii) Uniform Cost Search

→ A-B-C-D-F-G {As Smallest cost g=13}

(iv) A* Search with heuristic $h_1$

↳ Same as Uniform cost search as heuristic $h_1$ is consistent

A - B - C - D - F - G

(v) A* Search with heuristic $h_2$

↳ A - B - C - D - F - G

{Although $h_2$ is not consistent but optimal path is returned}

(b) (i)

$h_3^*(B) = 1+3+3+5 = 12$

$0 \leq h_3(B) \leq h_3^*(B)$

$h_3(B) \in [0, 12] \subset R$

(ii) $h_3(A) - h_3(B) \leq \text{Cost}(A \text{ to } B)$

$10 - h_3(B) \leq 1$

$h_3(B) \geq 9$

&

$h_3(B) - h_3(C) \leq \text{Cost}(B \text{ to } C)$

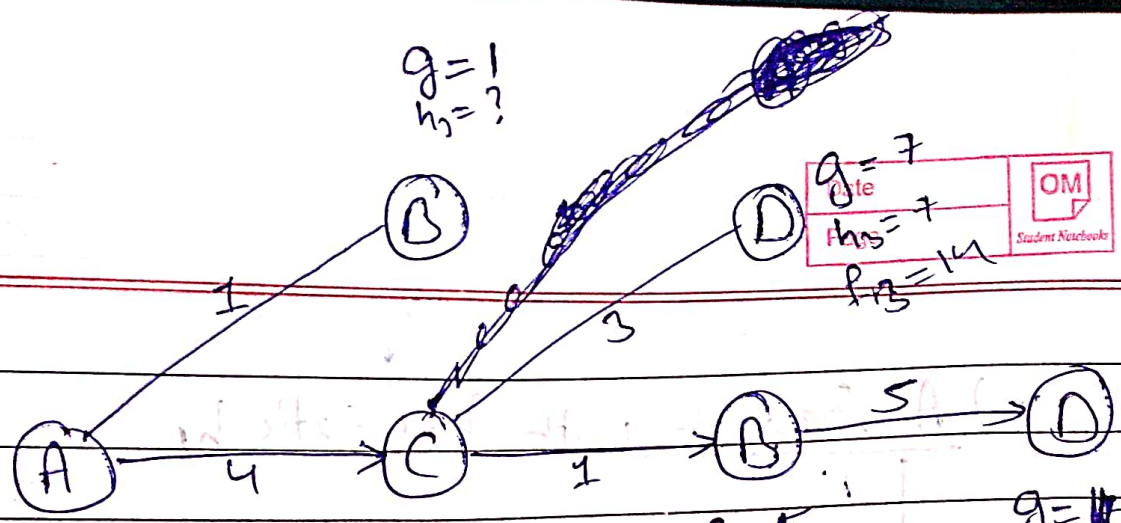
$h_3(B) \leq 1 + 9 = 10$

&

$h_3(B) - h_3(D) \leq \text{Cost}((B \text{ to } D)$

$h_3(B) \leq 5 + 7 = 12 \Rightarrow$ $h_3 \in [9, 10]$

(iii)




(A—C)*

(A—D)

* $h_3(B) + 1 \geq 13$ {first step}

$h_3(B) \geq 12$

(A—D)

(A—C—B)*

(A—C—D)

* $h_3(B) + 5 \leq 14$ {second step}

$h_3(B) + 5 \leq h_3(B) + 1$

This is not possible!

So $h_3(B) \in \phi$ {If A-C-B-D and first 3 expansion}