24-S1-Q2

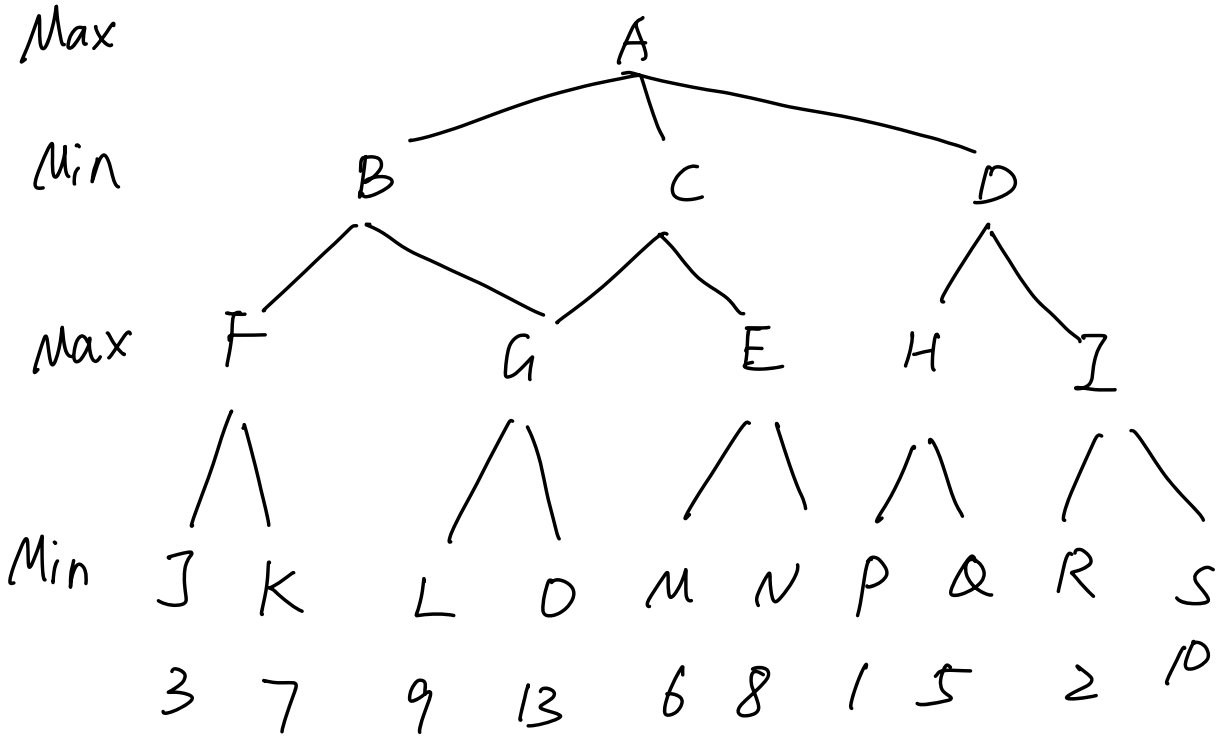
(a) first -> Max

(i) A -> B C D ?

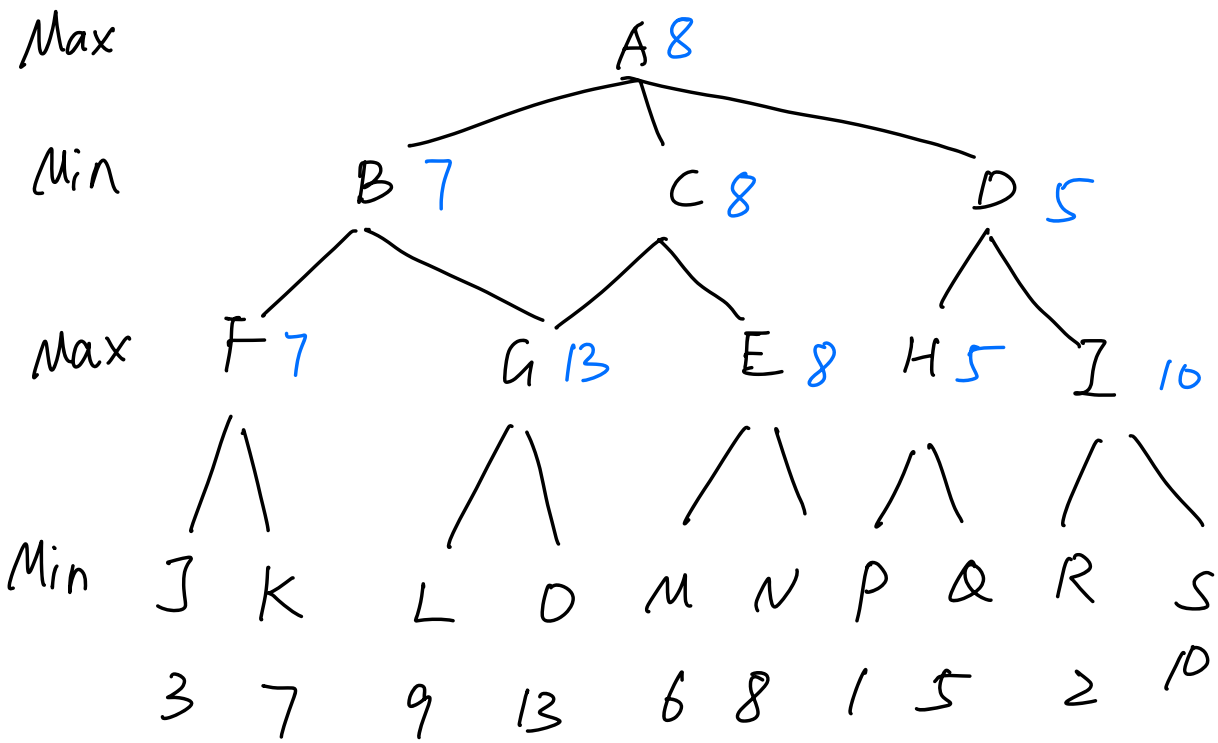
(ii) left -> right

(iii) not examined nodes

A-B pruning



Solution (a) (i) ① compute result



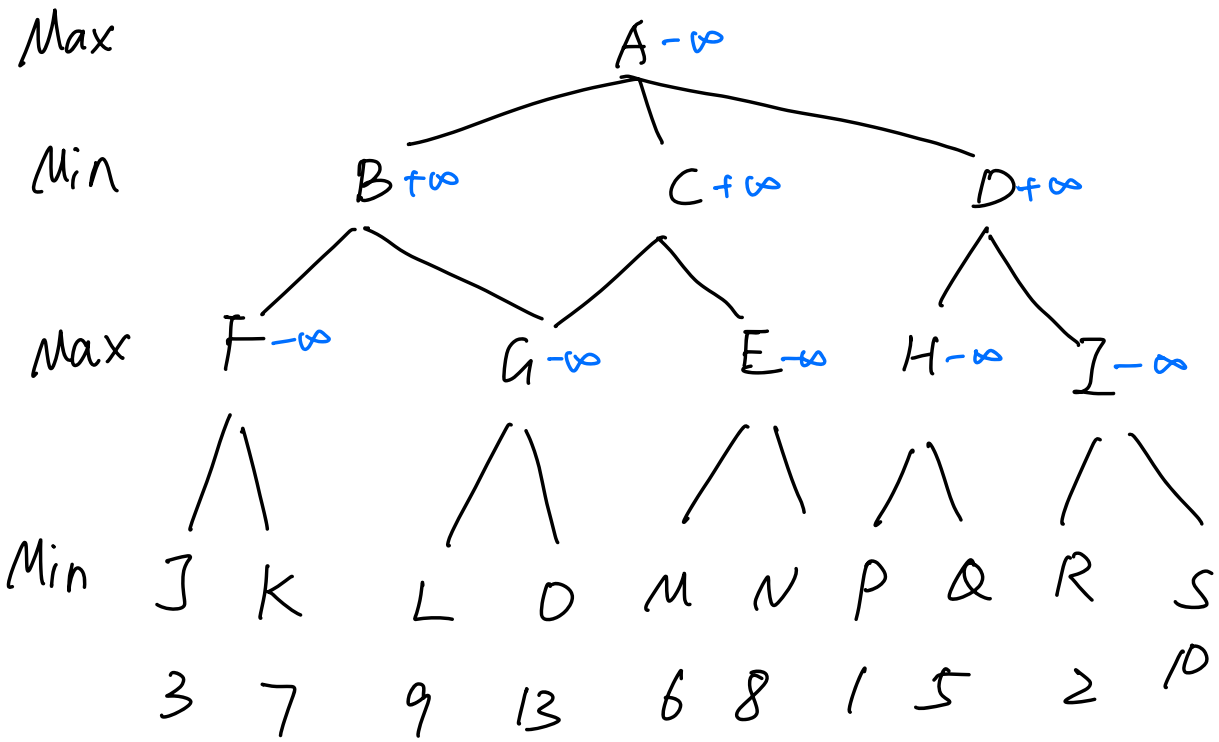
② the first player choose C

Since according to min-max algorithm the first player is a Max player

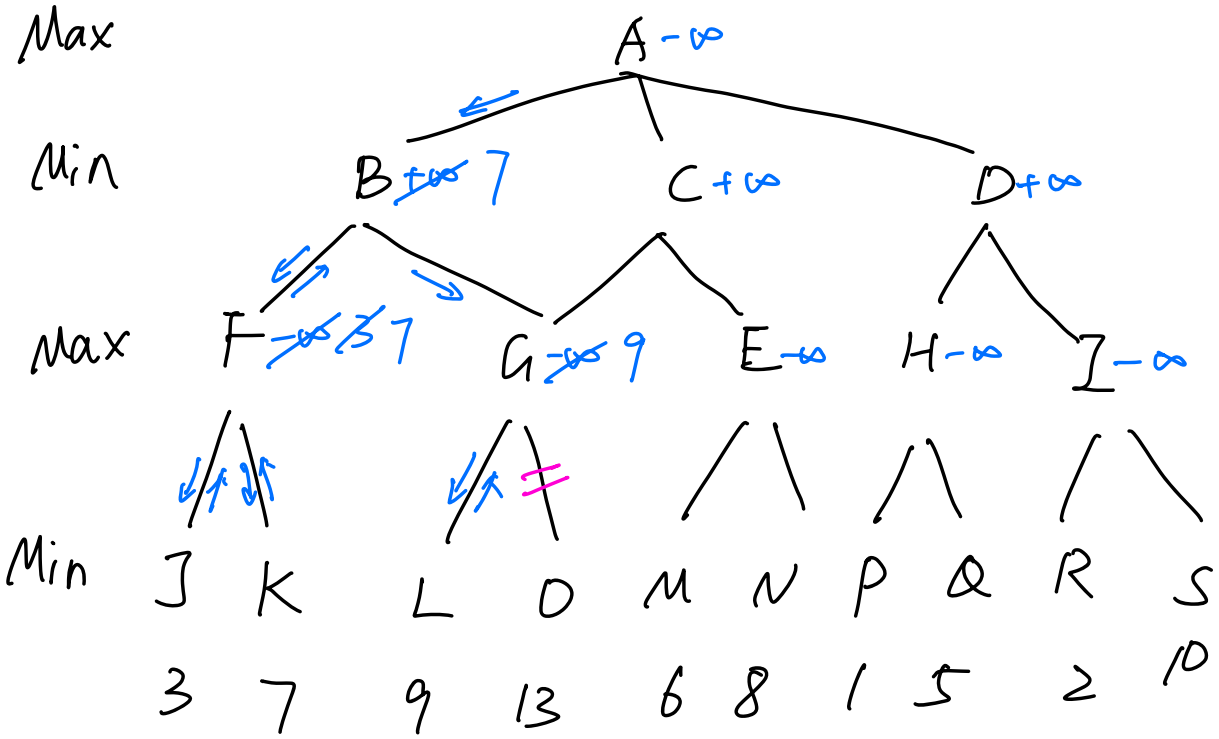
So he will choose the largest one

8 > 7 > 5 , C > B > D , so he will choose C

(ii) ① apply $\alpha - \beta$ pruning

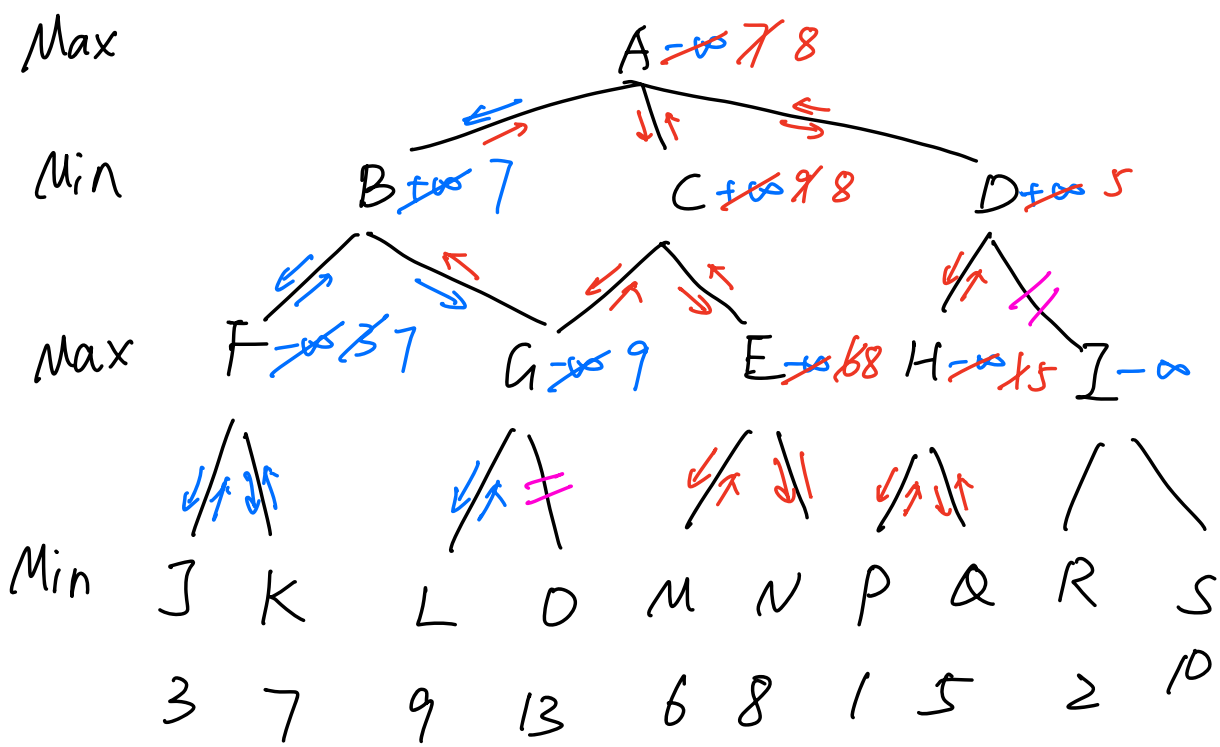


②



$9 > 7$, prune.

③

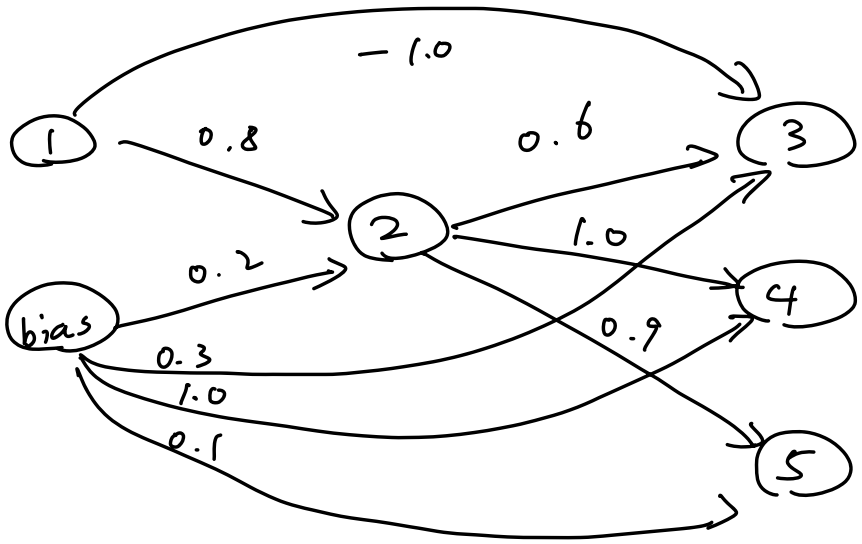


$5 < 8$ prune

(iii) not visited node.

O I R S

(b)



ReLu : hidden and output

output bias = 1.0

learning rate $\eta = 0.5$

error : $E = \frac{1}{2} \sum_k (t_k - o_k)^2$

t_k ↓ target output

o_k ↘ actual output

$net_j = \sum_i (w_{ji} o_i)$

net_j ↓ input

o_i ↓ include bias

$o_j = \sigma(net_j)$

o_j ↓ output

Backpropagation

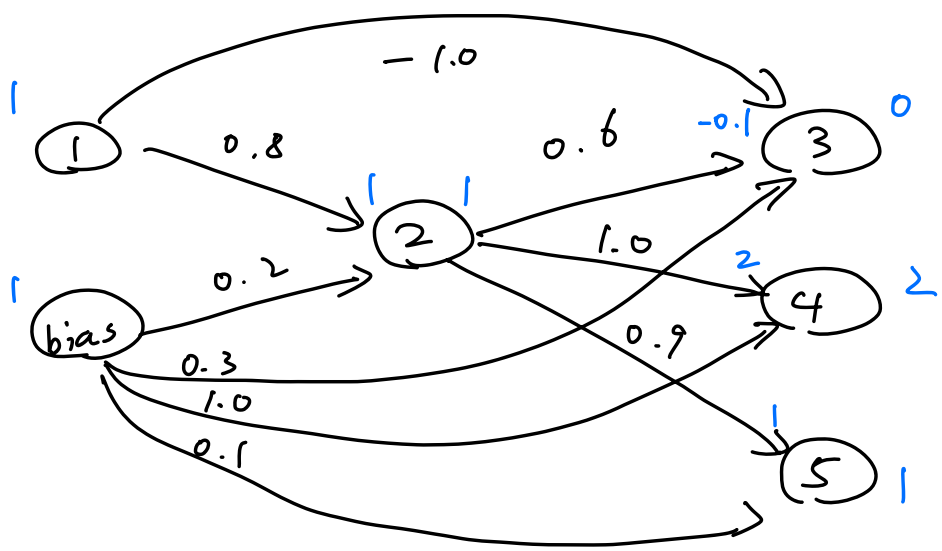
Q (i) $x = (1, 0) \rightarrow t\ (0.1, 0.9, 0.1)$

actual output. at 2, 3, 4, 5

(ii) error

(iii) bias of unit 2. → adjust

Solution (i) ① Forward-pass outputs



$x_1 = 1$ bias $= 1$

② $net_2 = 0.8 \times 1 + 0.2 \times 1 = 1$

$O_2 = ReLU(net_2) = ReLU(1) = 1$

③ $net_3 = (-1) \times 1 + 0.6 \times 1 + 0.3 \times 1 = -0.1$

$O_3 = ReLU(net_3) = ReLU(-0.1) = 0$

④ $net_4 = 1 \times 1 + 1 \times 1 = 2$

$O_4 = ReLU(net_4) = ReLU(2) = 2$

⑤ $net_5 = 0.9 \times 1 + 0.1 \times 1 = 1$

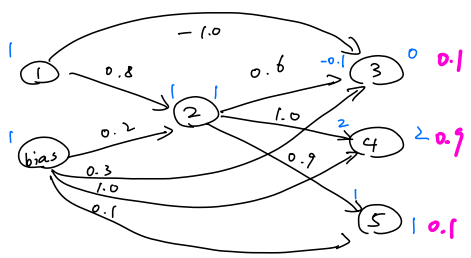
$O_5 = ReLU(net_5) = ReLU(1) = 1$

⑥ All in all, $O_2 = 1$, $O_3 = 0$, $O_4 = 2$, $O_5 = 1$

(ii) ① $\delta_3 = \frac{1}{2}(t_3 - O_3)^2$

$= \frac{1}{2}(0.1 - 0)^2$

$= 0.005$



② $\delta_4 = \frac{1}{2} \times (0.9 - 2)^2$

$= 0.605$

③ $\delta_5 = \frac{1}{2} \times (0.1 - 1)^2$

$= 0.405$

④ $\delta_2 = \sigma'(net_2) \sum_k \delta_k w_{k2}$

$= 0.005 \times 0.6 + 0.605 \times 1 + 0.405 \times 0.9$

$= 0.9725$

(3) All in All

δ_2	0.9725
δ_3	0.005
δ_4	0.605
δ_5	0.405

(iii) $\Delta w_{2,bias} = \eta \delta_2 O_{bias}$

$= 0.5 \times 0.9725 \times 1$

$= 0.48625$

$w_{2,bias} = 0.2 + 0.48625$

$= 0.68625$