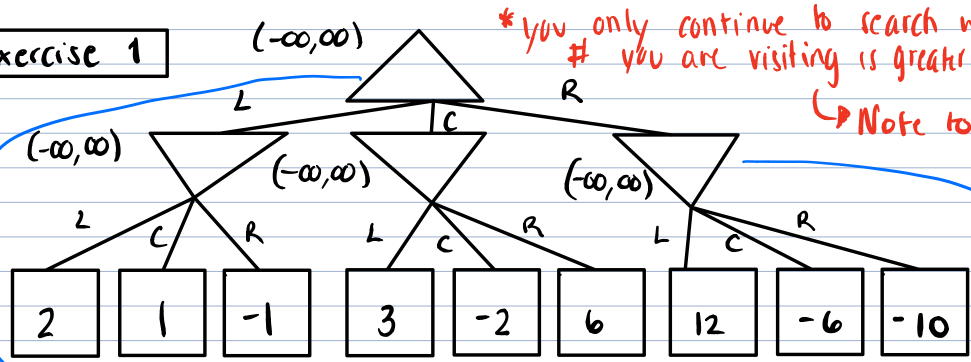
Exercise 1



*you only continue to search when the # you are visiting is greater than the first

↳ Note to Self

top level α and β

starting ① $\alpha = -\infty$ $\beta = \infty$

$v = -\infty$

② $\alpha = -1$ $\beta = \infty$

$v = -1$

visited
2
1
-1
3
-2
12
-6

-2 is less than -1 so we don't replace β b/c it wouldn't make sense: (-1, -2) is not a valid range

secondary α and β

starting ① $\alpha = -\infty$ $\beta = \infty$

$v = +\infty$

L

② $\alpha = -\infty$ $\beta = 2$

$v = 2$

③ $\alpha = -\infty$ $\beta = 1$

$v = 1$

④ $\alpha = -\infty$ $\beta = -1$

$v = -1$

C

⑤ $\alpha = 1$ $\beta = \infty$

$v = 3$

⑥ $\alpha = 1$ $\beta = \infty$

$v = -2$

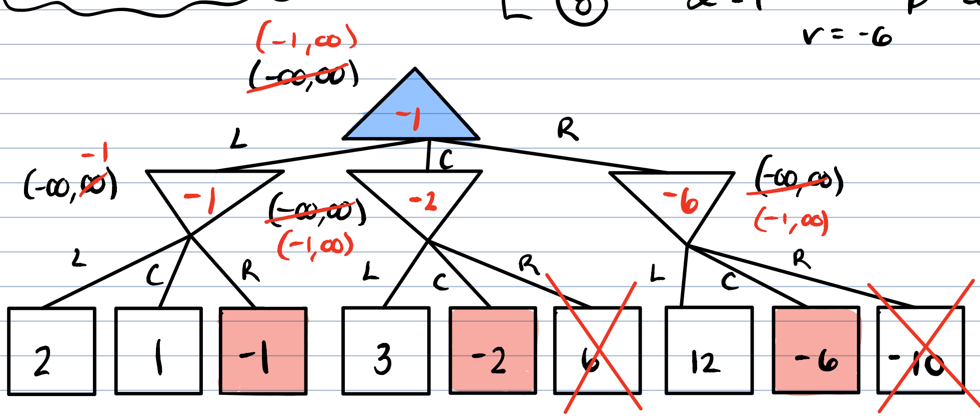
R

⑦ $\alpha = 1$ $\beta = \infty$

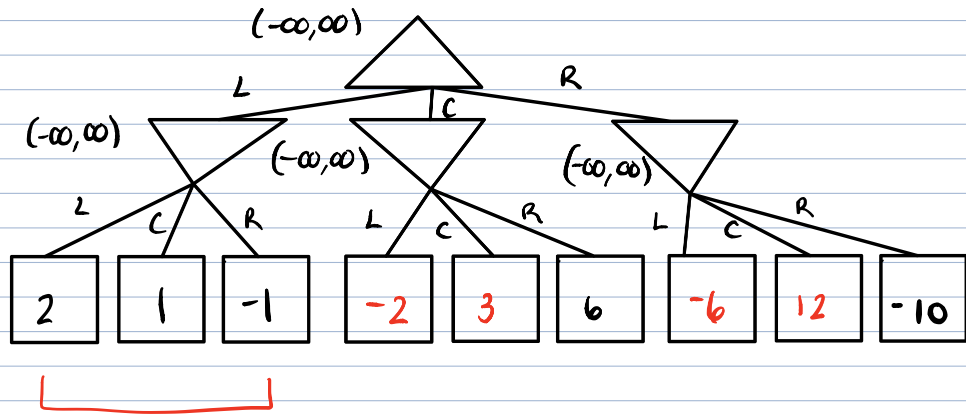
$v = 12$

⑧ $\alpha = 1$ $\beta = \infty$

$v = -6$



2.



no matter what, it has to visit these first 3 nodes to determine the min value.

* reordering the way I have will allow us to prune 4 branches as opposed to the original 2.

Exercise 2

→ 3 shooters, 1 shot
#1 hits with 50%, Misses with $1-P(A) = 50\%$
#2 hits with 60%, Misses with $1-P(B) = 40\%$
#3 hits with 70%, Misses with $1-P(C) = 30\%$

1. Probability that the shooters hit the target at least once.

$P(x \geq 1) =$

Shooters: {1, 2, 3}

H=hit
M=Miss

{H M M} - (.5)·(.4)·(.3) = 0.06 +
{M H M} - (.5)·(.6)·(.3) = 0.09 +
{M M H} - (.5)·(.4)·(.7) = 0.14 +
{H H M} - (.5)·(.6)·(.3) = 0.09 +
{H M H} - (.5)·(.4)·(.7) = 0.14 +
{M H H} - (.5)·(.6)·(.7) = 0.21 +
{H H H} - (.5)·(.6)·(.7) = 0.21
0.94 ⟹ $\boxed{94\%}$

2. Probability that the shooters hit the target at least twice.

$P(x \geq 2) =$

Shooters: {1, 2, 3}

{H H M} - (.5)·(.6)·(.3) = 0.09 +
{H M H} - (.5)·(.4)·(.7) = 0.14 +
{M H H} - (.5)·(.6)·(.7) = 0.21 +
{H H H} - (.5)·(.6)·(.7) = 0.21
0.65

$\boxed{65\%}$

$\boxed{\text{Exercise 3}}$

→ robot on mars works longer than 500 days ~ 0.25 → P(W)
- 3 are deployed

probability that aftr 500 days of service at least one of them works

* Probability that 1 robot fails ~ 0.75
* 3 robots who have that same probability ~ 0.75 * 0.75 * 0.75 or 0.75^3

$$1 - 0.75^3$$
$$1 - 0.421875$$
$$= \boxed{0.578125}$$

assuming that the robots fail independently of each other.

$\boxed{\text{Exercise 4}}$

- A and C are independent $\quad P(A \cap C) = P(A) \cdot P(C)$
- B and C " " $\quad P(B \cap C) = P(B) \cdot P(C)$
- A and B are disjoint $\quad P(A \cap B) = 0$

→ find $P(A), P(B), P(C)$

$P(A \cup C) = 1/3 \qquad P(B \cup C) = 1/2 \qquad P(A \cup B \cup C) = 2/3$

$P(A) + P(C) - P(A \cap C) \qquad P(B) + P(C) - P(B \cap C)$

$\hookrightarrow P(A) + P(C) - P(A) \cdot P(C) \qquad \hookrightarrow P(B) + P(C) - P(B) \cdot P(C)$

$$P(A) + P(B) + P(C) - \cancel{P(A \cap B)} - P(A \cap C) - P(B \cap C)$$

$$P(A) + P(B) + P(C) - [P(A) \cdot P(C)] - [P(B) \cdot P(C)]$$

$$P(A \cup C) + P(B \cup C) = P(A) + P(B) + 2[P(C) - (P(A) \cdot P(C)) - (P(B) \cdot P(C))]$$

$$P(A \cup C) + P(B \cup C) - P(A \cup B \cup C) = P(A) + P(B) + 2[P(C) - (P(A) \cdot P(C)) - P(B) \cdot (P(C)] - (P(A) + P(B) + P(C) - (P(A) \cdot P(C)) - (P(B) \cdot P(C)))$$

$$P(A \cup C) + P(B \cup C) - P(A \cup B \cup C) = P(C)$$

$$1/3 + 1/2 - 2/3 = P(C) \rightarrow \boxed{P(C) = 1/6}$$

$$P(A \cup C) = P(A) + 1/6 - (1/6 \cdot P(A))$$
$$1/3 = P(A) + 1/6 - 1/6\, P(A)$$
$$1/3 - 1/6 = P(A) - 1/6\, P(A)$$
$$1/6 = 5/6\, P(A) \rightarrow \frac{6}{5} \cdot 1/6 = P(A)$$
$$\frac{6}{30} = \boxed{\frac{1}{5} = P(A)}$$

$$P(B \cup C) = P(B) + 1/6 - (1/6 \cdot P(B))$$
$$1/2 = P(B) + 1/6 - 1/6\, P(B)$$
$$1/2 - 1/6 = P(B) - 1/6\, P(B)$$
$$2/6 = 5/6\, P(B) \rightarrow \frac{6}{5} \cdot \frac{2}{6} = P(B)$$
$$\frac{12}{30} = \boxed{\frac{2}{5} = P(B)}$$

$\boxed{\text{Exercise } 5}$

→ 6 coins, 5 regular and 1 Fake $P(H) = 1$

→ $P(R)$ = probability of regular coin $P(F)$ = fake

$P(H \mid R) = 0.5$

$P(H \mid F) = 1$

★ Probability of the coin landing heads up

so, $P(H) = P(H \mid R) \cdot P(R) + P(H \mid F) \cdot P(F)$ – Law of Total Prob.

$$(1/2) \cdot 5/6 + (1) \cdot 1/6$$

$$\left(\frac{1}{2} \cdot \frac{5}{6}\right) + \left(1 \cdot \frac{1}{6}\right)$$

$$\frac{5}{12} + \frac{1}{6}$$

$$\frac{5}{12} + \frac{2}{12} = \boxed{\frac{7}{12} = P(H) = 58.33\%}$$

fake

★ Pick a coin at random flip a heads, prob it is 2-headed?

$$P(R \mid H) = \frac{P(H \mid R) \cdot P(R)}{P(H)} = \frac{1/2 \cdot 5/6}{7/12} = \frac{5/12}{7/12} = \frac{5}{12} \cdot \frac{12}{7} = \frac{60}{84}$$

$$P(R \mid H) = \frac{5}{7} = 71.43\%$$

$$1 - P(R \mid H) = 1 - 71.43 = \boxed{28.57\%}$$