#

Q.N (1)

Left Right

1. 3 children (boat) →
   3 adult

Planning Problem
PDDL description

Constants: C_1 C_2 C_3 A_1 A_2 A_3

Predicates:

ischild(x) = x is a child

isadult(x) = x is an adult

onleft(x) = x is on left side of river

onright(x) = x is on right side of river

moveleft(x, y) = x and y moves to left side of river

moveright(x, y) = x and y moves to right side of river

boat(x) = x is a boat

initial state

ischild(C_1) ∧ ischild(C_2) ∧ ischild(C_3) ∧
isadult(A_1) ∧ isadult(A_2) ∧ isadult(A_3) ∧
onleft(C_1) ∧ onleft(C_2) ∧ onleft(C_3) ∧
onleft(A_1) ∧ onleft(A_2) ∧ onleft(A_3) ∧

Goal state:

onRight(C1) ∧ onRight(C2) ∧ onRight(C3) ∧ onRight(A1) ∧ onRight(A2) ∧ onRight(A3)

Action:

move A_C_from_L to R(x,y)

Precond:

onleft(x) ∧ onleft(y) ∧ onleft(boat) ∧ ischild(x) ∧ isadult(y)

effect:

onRight(x) ∧ onRight(y) ∧ ¬onleft(x) ∧ ¬onleft(y)

action:

move A_C from R to L (x,y)

Precond:

onRight(x) ∧ onRight(y) ∧ onRight(boat) ∧ ischild(x) ∧ isadult(y)

effect:

onleft(x) ∧ onleft(y) ∧ ¬onRight(x) ∧ ¬onRight(x)

action:

move C_C from L to R (x,y)

Precond:

onleft(x) ∧ onleft(y) ∧ onleft(boat) ∧ ischild(x) ∧ isadult(y)

effect:

onright(x) ∧ onright(x) ∧ ¬onleft(x) ∧ ¬onleft(x)

1 ✓ 4

2 5 ✓

3 6

action :
move C_C_R to L(x,y)
precond :
onright(x) ∧ onright(y) ∧ onright(boat) ∧ ischild(x) ∧ ischild(y)
effect :
onleft(x) ∧ onleft(y) ∧ ¬onright(x) ∧ ¬onright(y)

action :
move adult_L to R(x)
precond :
onleft(x) ∧ onleft(boat) ∧ isadult(x)
effect :
onright(x) ∧ ¬onleft(x)

action :
move adult_R to L(x)
Precond
onright(x) ∧ onright(boat) ∧ is.adult(x)
effect :
onleft(x) ∧ ¬onright(x)

action :
move child_L to_R(x)
precond :
onleft(x) ∧ onleft(boat) ∧ ischild(x)
effect :
onright(x) ∧ ¬onleft(x)

action : move child_R to_L(x)
precond : onright(x) ∧ onright(boat) ∧ ischild(x)
effect : onleft(x) ∧ ¬onright(x)

QN (2)

(2) (b)

$P(A=2 \vee B=4)$

$P(A=2) + P(B=4) - P(P(A)=2 \wedge P(B=4))$

Now,

$P(A=2) = 0.0061 + 0.0174 + 0.0342 + 0.0599 + 0.0603$

$= 0.1779$

$P(B=4) = 0.0571 + 0.0599 + 0.0303 + 0.0497 + 0.0584$

$= 0.2554$

Now,

$P = 0.1179 + 0.2554 - 0.0599$

$= 0.3734$

(c) $P(A \neq B)$

$= 1 - P(A=B)$

$= 1 - (0.0509 + 0.0174 + 0.0598 + 0.0497 + 0.0424)$

$= 1 - 0.2202$

$= 0.7798$

(d) $P(A|B) = P(A)$ for totally independent

let

$A = (A=1)$, $B = (B=1)$

$$P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{0.0509}{0.1168}$$

$$= 0.4358$$

$$P(A) = P(A=1) = \frac{0.0509 + 0.0566 + 0.0079 + 0.0571}{0.0395}$$

$$= 0.212$$

Therefore,

$P(A|B) \neq P(A)$ so, they are totally independent

Q N (5)

(1) Patrons ⟶ waitestimate ⟶ Hungry ⟶ Alternate

↓

Raining

↓

T

output will wait

(2) Patrons ⟶ leftmost child (None)

output will not wait

(3) Patrons ⟶ waitEstimate ⟶ Alternate

↓

Fri/Sat ?

↓

T

Output will wait

initial entropy

$= -\frac{6}{12}\log\frac{6}{12} - \frac{6}{12}\log\frac{6}{12}$

$= 1$

QN (6)

(6)

A	total	1	2	3
X	6	2	2	2
Y	6	2	2	2

For A,

$$I = 1 - \frac{4}{12}H\left(\frac{2}{4}, \frac{2}{4}\right) - \frac{4}{12}H\left(\frac{2}{4}, \frac{2}{4}\right) - \frac{4}{12}\left(\frac{2}{4}, \frac{2}{4}\right)$$

$$= 1 - \frac{2}{4}\cdot\frac{1}{3}\left(-\log_2\frac{2}{4} - \log_2\frac{2}{4}\right) - \frac{2}{4}\cdot\frac{1}{3}\left(-\log_2\frac{2}{4} - \log_2\frac{2}{4}\right)$$

$$-\frac{2}{4}\cdot\frac{1}{3}\left(-\log_2\frac{2}{4} - \log_2\frac{2}{4}\right)$$

$$= 1 - \frac{2}{4}\cdot\frac{1}{3}\left(2\right) - \frac{2}{4}\cdot\frac{1}{3}\left(2\right) - \frac{2}{4}\cdot\frac{1}{3}\left(2\right)$$

$$= 1 - \frac{1}{3} - \frac{1}{3} - \frac{1}{3}$$

$= 0$ (Information gained)

0.809

For b,

B	total	1	2	3
X	6	1	2	3
Y	6	1	3	2

$$I = 1 - \frac{2}{12}H\left(\frac{1}{2}, \frac{1}{2}\right) - \frac{5}{12}H\left(\frac{2}{5}, \frac{3}{5}\right) - \frac{5}{12}H\left(\frac{3}{5}, \frac{2}{5}\right)$$

$$= 1 - \frac{1}{6}\left(\frac{1}{2} \times -\log_2 \frac{1}{2} - \frac{1}{2}\log_2 \frac{1}{2}\right) - \frac{5}{12}\left(-\log_2 \frac{2}{5} \times \frac{2}{5} - \frac{3}{5}\log_2 \frac{3}{5}\right)$$

$$- \frac{5}{12}\left(\frac{3}{5} \times -\log_2 \frac{3}{5} - \frac{2}{5} \times \log_2 \frac{2}{5}\right)$$

$$= 1 - \frac{1}{6} - \frac{5}{12}(0.9709) - \frac{5}{12}(0.9709)$$

$$= 0.0243$$

1V 5V

2 ↑ 2/3

4

(c) For C,

C	total	1	2	3
X	6	4	2	0
Y	6	0	2	4

$$I = 1 - \frac{4}{12} H\left(\frac{4}{4}, \frac{0}{4}\right) - \frac{4}{12}\left(\frac{2}{4}, \frac{2}{4}\right) - \frac{4}{12}\left(0, \frac{4}{4}\right)$$

$$= 1 - \frac{4}{12}\left(-1 \log_2 \frac{4}{4} - 0 \log_2 0\right) - \frac{4}{12}\left(-\frac{2}{4} \times \log_2 \frac{2}{4} - \frac{2}{4} \times \log_2 \frac{2}{4}\right)$$

$$- \frac{4}{12}\left(0 - 1 \log_2 \frac{4}{4}\right)$$

$$= 1 - \frac{4}{12} \times 0 - \frac{4}{12} \times 1 - \frac{4}{12} \times 0$$

$$= 1 - \frac{4}{12} \frac{1}{3}$$

$$= 0.6667$$

Therefore, information gained of C is greater than A and B so, attribute C is best to use as a test in the root of the tree.