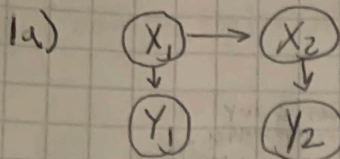


Sam Hopkins
CS 470 HW 4



b) $p(x_1) = \langle .25, .25, .25, .25 \rangle$

c) ~~$P(A) = P(A|X_1=A)P(X_1=A) + P(A|X_1=B)P(X_1=B) + P(A|X_1=C)P(X_1=C) + P(A|X_1=D)P(X_1=D)$~~

The sensor module is given by the table.

d) $p(x_1 | y_1 = D) = P(D)$

$p(x_1 | y_1 = D) = \langle .474, .368, .105, .0526 \rangle$

P	A	C	B
$.25 \cdot .9 + .25 \cdot .7 + .25 \cdot .2 + .25 \cdot .1$	$.25 \cdot .7 + .25 \cdot .3 + .25 \cdot .8 + .25 \cdot .4$	$.25 \cdot .2 + .25 \cdot .8 + .25 \cdot .3 + .25 \cdot .4$	$.25 \cdot .1 + .25 \cdot .4 + .25 \cdot .3 + .25 \cdot .9$
$.225 + .175 + .05 + .025 = .475$	$.175 + .075 + .2 + .1 = .45$	$.05 + .2 + .075 + .1 = .425$	$.025 + .1 + .075 + .225 = .425$
$.474$	$.368$	$.105$	$.0526$

e) $p(x_{t+1} | x_t) = A = P(A) \cdot .7 + P(P) \cdot .3 + P(B) \cdot .3 + P(C) \cdot .3$
 $P(P | x_t) = P = P(P) \cdot .7 + P(A) \cdot .3 + P(C) \cdot .3 + P(B) \cdot .3$
 $C = P(C) \cdot .7 + P(B) \cdot .3 + P(A) \cdot .3 + P(P) \cdot .3$
 $B = P(B) \cdot .7 + P(C) \cdot .3 + P(A) \cdot .3 + P(P) \cdot .3$ (9997)

P	A	C	B
$.474 \cdot .7 + .368 \cdot .7 + .105 \cdot .7 + .0526 \cdot .7$	$.368 \cdot .7 + .474 \cdot .3 + .0526 \cdot .3 + .105 \cdot .3$	$.105 \cdot .7 + .368 \cdot .3 + .474 \cdot .3 + .0526 \cdot .3$	$.0526 \cdot .7 + .105 \cdot .3 + .474 \cdot .3 + .368 \cdot .3$
$.23226$	$.18032$	$.05145$	$.025774$
$+ .0728$	$+ .09454$	$+ .011046$	$+ .02205$
$+ .02205$	$+ .011046$	$+ .03312$	$+ .07728$
$+ .004734$	$+ .00945$	$+ .09454$	$+ .04266$
$= .3363$	$+ .3004$	$+ .1952$	$+ .1678$

$p(x_2 | y_1 = D) = \langle .3363, .3004, .1952, .1678 \rangle$

g) $p(x_2 | y_1 = D, y_2 = L)$

$\langle .078, .209, .362, .350 \rangle$

P	A	C	B
$.3363 \cdot .1$	$.3004 \cdot .3$	$.1952 \cdot .8$	$.1678 \cdot .9$
$.03363$	$.09012$	$.15616$	$.15102$
\downarrow	\downarrow	\downarrow	\downarrow
$\rightarrow .078$	$.209$	$.362$	$.350$

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CS 470
hw5

2. a) total = 4.17

$$\begin{aligned} 1 &= .93/4.17 = .22 \\ 2 &= .09/4.17 = .02 \\ 3 &= .18/4.17 = .04 \\ 4 &= .46/4.17 = .11 \\ 5 &= .49/4.17 = .12 \end{aligned}$$

$$\begin{aligned} 6 &= .34/4.17 = .09 \\ 7 &= .17/4.17 = .04 \\ 8 &= .88/4.17 = .21 \\ 9 &= .6/4.17 = .14 \\ 10 &= .02/4.17 = .01 \end{aligned}$$

b) Set 1 = $P(1, 8, 8, 4, 5) = .0001281$
Set 2 = $P(2, 1, 1, 8, 8) = .0007159$
Set 3 = $P(5, 4, 9, 1, 1) = .0000894$

Set 2 is most likely

right left
up down ~~right~~
0 0 0 0

3. a) Location: A, 0001, $P_s = .9$

correct = 0, 0, 0, 1 $.9 \cdot .9 \cdot .9 \cdot .9 = .6561$

b) Location: B, 1011, $P_s = .75$

correct = 1, 0, 1, 0 $.75 \cdot .75 \cdot .75 \cdot .25 = .1055$

c) C, 0111, .7

correct: 0, 1, 0, 1 $.7 \cdot .7 \cdot .3 \cdot .7 = .1029$

d) D, 0110, .6

correct: 0, 0, 1, 1 $.6 \cdot .4 \cdot .6 \cdot .4 = .0576$

e) E, 1011, .8

correct: 0, 0, 0, 0 $.2 \cdot .8 \cdot .2 \cdot .2 = .0064$