Cpt_S540_hw08

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1 hw 8

1.1 1

1.1.1 a.

$breeze = \neg b_{1,1} \wedge \neg b_{1,2} \wedge \neg b_{1,3} \wedge \neg b_{2,3} \wedge b_{3,3}$
$known = \neg p_{1,1} \wedge \neg p_{1,2} \wedge \neg p_{1,3} \wedge \neg p_{2,3} \wedge \neg p_{3,3}$
$frontier = \{p_{3,2}, p_{4,3}\}$
$query = p_{3,4}$ $other =$ other 8 pit variables.

1.1.2 b.

$\mathbf{P}(p_{3,4}|breeze, know)$
$=\mathbf{P}(p_{3,4} \wedge breeze \wedge know)/P(breeze \wedge know)$
$=\alpha\mathbf{P}(p_{3,4} \wedge breeze \wedge know)$
$=\alpha\mathbf{P}(p_{3,4}) \sum_{frontier} \mathbf{P}(breeze|p_{3,4}, know, frontier)P(frontier)$
$=\alpha < 0.2(0.2 * 0.2 + 0.2 * 0.8 * 2 + 0.8 * 0.8), 0.8(0.2 * 0.2 + 0.2 * 0.8 * 2) >$
$=\alpha < 0.2(0.04 + 0.16 * 2 + 0.64), 0.8(0.04 + 0.16 * 2) >$
$=\alpha < 0.2, 0.288 >$
$=< 0.4098, 0.5902 >$

1.2 2

1.3 3

1.3.1 a.

$P(AIDone = true, Costume = false, Party = true, HaveFun = true, MakeFriends = true)$
$= 0.4 * 0.7 * 0.5 * 0.6 * 0.7$
$= 0.0588$

1.3.2 b.

$P(HaveFun = true|AIDone = false, Costume = true)$
$= P(Party = true|AIDone = false, Costume = true) * P(HaveFun = true|Party =$

$true) + P(Party = false|AIDone = false, Costume = true) * P(HaveFun = true|Party = false)$
$= 0.4 * 0.6 + 0.6 * 0.2$
$= 0.36$

1.3.3 c.

Compute $\mathbf{P}(AIDone|HaveFun = true, MakeFriends = true)$
$= \mathbf{P}(HaveFun = true, MakeFriends = true|AIDone) * \mathbf{P}(AIDone)/P(HaveFun = true, MakeFriends = true)$
$= \alpha < P(HaveFun = true, MakeFriends = true|AIDone = true) * P(AIDone = true), P(HaveFun = true, MakeFriends = true|AIDone = false) * P(AIDone = false) >$
$= \alpha < 0.4[0.6 * 0.7(0.3 * 0.9 + 0.7 * 0.5) + 0.2 * 0.4(0.3 * 0.1 + 0.7 * 0.5)],$
$0.6[0.6 * 0.7(0.3 * 0.4 + 0.7 * 0.2) + 0.2 * 0.4(0.3 * 0.6 + 0.7 * 0.8)] >$
$= \alpha < 0.11632, 0.10104 >$
$=< 0.5351, 0.4649 >$
So, $P(AIDone = true|HaveFun = true, MakeFriends = true) = 0.5351$

1.4 4

1.5 5

1.6 6

$\mathbf{P}(AIDone) =< 0.4, 0.6 >$, AIDone=false
$\mathbf{P}(Costume) =< 0.3, 0.7 >$, Costume=false
$\mathbf{P}(Party|AIDone = false, Costume = false) =< 0.2, 0.8 >$, Party=false
$\mathbf{P}(HaveFun|Party = false) =< 0.2, 0.8 >$, HaveFun=false
$\mathbf{P}(MakeFriends|Party = false) =< 0.4, 0.6 >$, MakeFriends=false
Finally, the most likely sample is [false,false,false,false,false]

1.7 7

$\mathbf{P}(AIDone) =< 0.4, 0.6 >$, AIDone=true
$\mathbf{P}(Costume) =< 0.3, 0.7 >$, Costume=true
$\mathbf{P}(Party|AIDone = true, Costume = true) =< 0.9, 0.1 >$, Party=false
$\mathbf{P}(HaveFun|Party = false) =< 0.2, 0.8 >$, HaveFun=true
$\mathbf{P}(MakeFriends|Party = false) =< 0.4, 0.6 >$, MakeFriends=true
Finally, the least likely sample is [true,true,false,true,true]