CS331 Written Assignment #4

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1.

a) True

b) False

c) True

d) False

e) True

2.

a) $P(A=\text{true}, B=\text{false}, C=\text{false}, D=\text{false}, E=\text{false})$

$= P(a, \neg b, \neg c, \neg d, \neg e)$

$= P(a)P(\neg b|a)P(\neg c|a)P(\neg d|\neg c)P(\neg e|\neg b, \neg d)$

$= (0.4)\cdot(0.1)\cdot(0.75)\cdot(0.1)\cdot(0.6)$

$= \boxed{0.0018}$

b) $P(A=\text{true}, B=\text{true}, D=\text{false})$

$= P(a, b, \neg d)$

$= \sum_c \sum_e P(a)P(b|a)P(c|a)P(\neg d|c)P(e|b,\neg d)$

$= P(a)P(b|a)\sum_c P(c|a)P(\neg d|c)\sum_e P(e|b,\neg d)$

$= (0.4)(0.9)(0.25\cdot 0.25(0.2+0.8) + 0.75\cdot 0.1(0.2+0.8))$

$= \boxed{0.0495}$

c) $P(D=\text{true} \mid A=\text{true})$

$= P(d|a)$

$= \alpha P(d,a)$

$= \alpha P(a,d)$

$= \alpha \sum_b \sum_c \sum_e P(a)P(b|a)P(c|a)P(d|c)P(e|b,d)$

$= \alpha P(a)\sum_c P(c|a)P(d|c)\sum_b P(b|a)\sum_e P(e|b,d)$

$= \alpha(0.4)(0.25\cdot 0.75\underbrace{(0.9\underbrace{(0.1+0.9)}_{1}+0.1\underbrace{(0.3+0.7)}_{1})}_{1} + 0.75\cdot 0.9\underbrace{(0.9\underbrace{(0.1+0.9)}_{1}+0.1\underbrace{(0.3+0.7)}_{1})}_{1})$

$= \alpha(0.4)(0.25\cdot 0.75 + 0.75\cdot 0.9)$

$= \alpha(0.050625) = \frac{1}{P(a)}(0.050625) = \frac{1}{0.4}(0.050625) = (2.5)(0.050625) = \boxed{0.1265625}$