

## Assignment 3 Question 1 Solution

(a)  $A \rightarrow C \rightarrow E$

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v v

$B \rightarrow D$

$\Pr(a) \Pr(b|a) \Pr(c|a) \Pr(d|b,c) \Pr(e|c)$

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

(b)  $A \rightarrow B \rightarrow D$

$\Pr(a,b,d) = \Pr(a)\Pr(b|a)\Pr(d|b)$

Hence:-

$\Pr(d|a,b) = \Pr(a,b,d)/\Pr(a,b) = \Pr(a)\Pr(b|a)\Pr(d|b)/\Pr(a)\Pr(b|a) = \Pr(d|b)$

a is independent of d given b

(c) patient suffers e but not d

$\Pr(a,b,c,\sim d,e) = \Pr(a)\Pr(b|a)\Pr(c|a)\Pr(\sim d|b,c)\Pr(e|c) = 0.512\%$

$\Pr(a,b,\sim c,\sim d,e) = \Pr(a)\Pr(b|a)\Pr(\sim c|a)\Pr(\sim d|b,\sim c)\Pr(e|\sim c) = 1.536\%$

$\Pr(a,\sim b,c,\sim d,e) = \Pr(a)\Pr(\sim b|a)\Pr(c|a)\Pr(\sim d|\sim b,c)\Pr(e|c) = 0.128\%$

$\Pr(a,\sim b,\sim c,\sim d,e) = \Pr(a)\Pr(\sim b|a)\Pr(\sim c|a)\Pr(\sim d|\sim b,\sim c)\Pr(e|\sim c) = 1.824\%$

$\Pr(\sim a,b,c,\sim d,e) = \Pr(\sim a)\Pr(b|\sim a)\Pr(c|\sim a)\Pr(\sim d|b,c)\Pr(e|c) = 0.128\%$

$\Pr(\sim a,b,\sim c,\sim d,e) = \Pr(\sim a)\Pr(b|\sim a)\Pr(\sim c|\sim a)\Pr(\sim d|b,\sim c)\Pr(e|\sim c) = 1.824\%$

$\Pr(\sim a,\sim b,c,\sim d,e) = \Pr(\sim a)\Pr(\sim b|\sim a)\Pr(c|\sim a)\Pr(\sim d|\sim b,c)\Pr(e|c) = 0.512\%$

$\Pr(\sim a,\sim b,\sim c,\sim d,e) = \Pr(\sim a)\Pr(\sim b|\sim a)\Pr(\sim c|\sim a)\Pr(\sim d|\sim b,\sim c)\Pr(e|\sim c) = 34.656\%$

(d) Less inclined to believe they have cancer. None of them exceeded the probability for having metastatic cancer as Highest:  $1.824\% < \text{Priori: } 2\%$