BELIEF NETS – PRACTICE PROBLEMS FOR THE FINAL EXAM
CS534 ARTIFICIAL INTELLIGENCE. S98
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Modeling Belief Nets :

1. From Russell and Norvig: 15.1, 15.2, 15.3, 15.4 (a,b,c only), 15.5, 15.6.
2. From Dean, Allen, and Aloimonos: 8.1 – 8.5, 8-7, 8.8.
3. From Luger and Stubblefield: 7, 8, 9.

Inference in Belief Nets :

1. Derive all the conditional probabilities given by Russell and Norvig on p. 447 for the Burglary–Earthquake example.
2. Consider the belief net on p. 446 (Russell and Norvig's book). Assume the prior and conditional probabilities given below:
   - $P(B) = 0.95$
   - $P(R|B) = .8 \qquad P(R|\neg B) = 0$
   - $P(I|B) = 0.98 \qquad P(I|\neg B) = 0$
   - $P(G) = 0.65$
   - $P(S|I,G) = 0.9 \qquad P(S|I,\neg G) = 0 \qquad P(S|\neg I,G) = 0 \qquad P(S|\neg I,\ G) = 0$
   - $P(M|S) = 0.7 \qquad P(M|\neg S) = 0$

   Compute the following conditional probabilities (follow the algorithm on p. 452 as much as possible):

   (a) *(diagnosis)* $P(\neg B|\neg M)$
   (b) *(causal inference)* $P(\neg M|\neg B)$
   (c) *(intercausal inference)* $P(\neg G|S,I)$
   (d) *(mixed inference)* $P(R,G|I)$ (Hint: note that R and G are conditionally independent given I.)
   (e) *Multiple connected belief nets*: Add a root node event "Maintenance" (abbreviated by "A") which influences Ignition and Gas:
   $P(A) = 0.85 \qquad P(I|A) = 0.9 \qquad P(G|A) = 0.8.$
   Using the clustering method, find $P(M|A)$.
