# CS-171, Intro to A.I., Fall Quarter, 2018—Quiz # 2—20 minutes

NAME: _____ UCI NetID: _____

YOUR ID: _____ ID TO RIGHT: _____ ROW: _____ SEAT: _____

**1. (10 pts total) Probability.** Use the definition of conditional probability to show that P(a | b ∧ a) = 1. **Show your work!**

P(a | b ∧ a) =

**2. (10 pts total) Bayes'Rule.** Write down the expression that results from applying Bayes' Rule to P(H | D).

P(H | D) =

**3. (10 pts total) P(H ∧ D) [1].** Write down the expression for P(H ∧ D) in terms of P(H), P(D), and P(H ∨ D).

P(H ∧ D) =

**4. (10 pts total) P(H ∧ D) [2].** Write down the expression for P(H ∧ D) in terms of P(D) and P(H | D).

P(H ∧ D) =

**5. (30 pts total, 10 pts each)** Consider the following joint distribution (R&N Fig. 13.3; t = *toothache*, d = *dental pick catches*, c = *cavity*). An arithmetic expression contains only numbers, parentheses, and +, –, *, and /.
**Write an arithmetic expression for each of the following expressions.**

| | t | | ¬t | |
|---|---|---|---|---|
| | d | ¬d | d | ¬d |
| c | 0.108 | 0.012 | 0.072 | 0.008 |
| ¬c | 0.016 | 0.064 | 0.144 | 0.576 |

**5.a. (10 pts)** P(t ∧ ¬d ∧ c) = _____

**5.b. (10 pts)** P(¬t ∨ ¬c) = _____

**5.c. (10 pts)** P(c | t ∧ d) = _____

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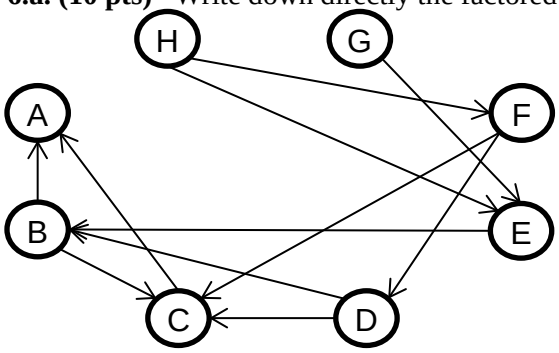
**6. (30 pts total, 10 pts each) BAYESIAN NETWORKS.**

**6.a. (10 pts)** Write down directly the factored conditional probability expression corresponding to this network:

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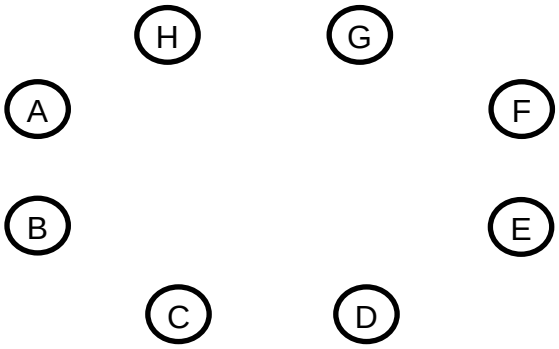
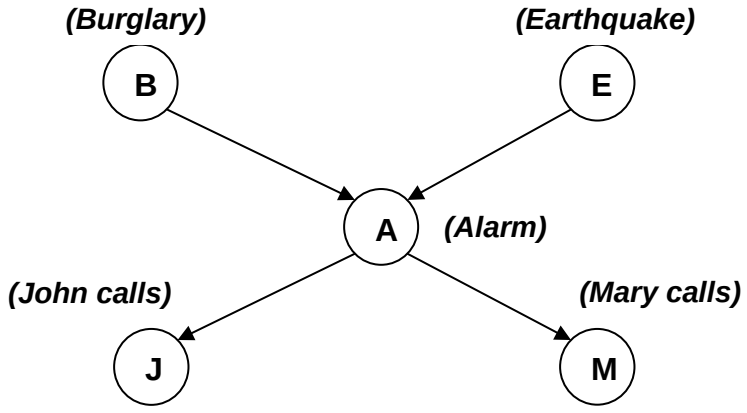
**6.b. (10 pts)** Draw the Bayesian Network corresponding to this factored conditional probability expression:

P(A | C, D) P(B | C, E) P(C | E) P(D | E, F, G) P(E | H) P(F | G, H) P(G) P(H | G)




**6.c. (10 pts)** Shown below is the Bayesian network corresponding to the Burglar Alarm problem, i.e., P(J,M,A,B,E) = P(J | A) P(M | A) P(A | B, E) P(B) P(E). This is Fig. 14.2 in your R&N textbook.




| P(B) |
|---|
| .001 |

| P(E) |
|---|
| .002 |

| B | E | P(A) |
|---|---|---|
| t | t | .95 |
| t | f | .94 |
| f | t | .29 |
| f | f | .001 |

| A | P(J) |
|---|---|
| t | .90 |
| f | .05 |

| A | P(M) |
|---|---|
| t | .70 |
| f | .01 |

Write down an expression that will evaluate to P( J=f ∧ M=t ∧ A=t ∧ B=t ∧ E=f ). **Express your answer as a series of numbers (numerical probabilities) separated by multiplication symbols.** You do not need to carry out the multiplication to produce a single number (probability). **SHOW YOUR WORK, first as the symbolic conditional probabilities from the graphs, then as the corresponding numeric probabilities from the tables above.**

P( J=f ∧ M=t ∧ A=t ∧ B=t ∧ E=f )

[put symbolic here] = _____

[put numeric here] = _____

**Scratch Paper (1) Please Do Not Detach From Test**

**Scratch Paper (2) Please Do Not Detach From Test**