CS-171, Intro to A.I. — Quiz#4 — Winter Quarter, 2016 — 20 minutes

YOUR NAME: ____

YOUR ID: ____________ ID TO RIGHT: _____________ ROW: _________ SEAT: _________

1. (70 pts total, 10 pts each) For each English sentence below, write the letter corresponding to its best or closest FOPC (FOL) sentence (wff, or well-formed formula). The first one is done for you, as an example.

1.a (example) __D__ "Every butterfly likes some flower."
- A. ∀x ∀y Butterfly(x) ∧ Flower(y) ∧ Likes(x, y)
- B. ∀x ∃y Butterfly(x) ∧ Flower(y) ∧ Likes(x, y)
- C. ∀x ∀y Butterfly(x) ⇒ (Flower(y) ∧ Likes(x, y))
- D. ∀x ∃y Butterfly(x) ⇒ (Flower(y) ∧ Likes(x, y))

1.b (10 pts) ____ "All butterflies are insects."
- A. ∀x Butterfly(x) ∧ Insect(x)
- B. ∀x Butterfly(x) ⇒ Insect(x)
- C. ∃x Butterfly(x) ∧ Insect(x)
- D. ∃x Butterfly(x) ⇒ Insect(x)

1.c (10 pts) ____ "For every flower, there is a butterfly that likes that flower."
- A. ∀x ∃y Flower(x) ∧ Butterfly(y) ∧ Likes(y, x)
- B. ∀x ∃y [Flower(x) ∧ Butterfly(y)] ⇒ Likes(y, x)
- C. ∀x ∃y Flower(x) ⇒ [Butterfly(y) ∧ Likes(y, x)]
- D. ∀x ∀y Flower(x) ∧ Butterfly(y) ∧ Likes(y, x)

1.d (10 pts) ____ "Every butterfly likes every flower."
- A. ∀x ∀y [Butterfly(x) ∧ Flower(y)] ⇒ Likes(x, y)
- B. ∀x ∀y Butterfly(x) ⇒ [Flower(y) ∧ Likes(x, y)]
- C. ∀x ∀y Butterfly(x) ∧ Flower(y) ∧ Likes(x, y)
- D. ∀x ∃y [Butterfly(x) ∧ Flower(y)] ⇒ Likes(x, y)

1.e (10 pts) ____ "There is some butterfly in Irvine that is pretty."
- A. ∀x Butterfly(x) ∧ In(x, Irvine) ∧ Pretty(x)
- B. ∃x Butterfly(x) ∧ In(x, Irvine) ∧ Pretty(x)
- C. ∀x [Butterfly(x) ∧ In(x, Irvine)] ⇒ Pretty(x)
- D. ∃x Butterfly(x) ⇒ [In(x, Irvine) ∧ Pretty(x)]

1.f (10 pts) _____ "Every butterfly in Irvine is pretty."
- A. ∀x Butterfly(x) ∧ In(x, Irvine) ∧ Pretty(x)
- B. ∃x Butterfly(x) ∧ In(x, Irvine) ∧ Pretty(x)
- C. ∀x [Butterfly(x) ∧ In(x, Irvine)] ⇒ Pretty(x)
- D. ∃x Butterfly(x) ⇒ [In(x, Irvine)] ∧ Pretty(x)

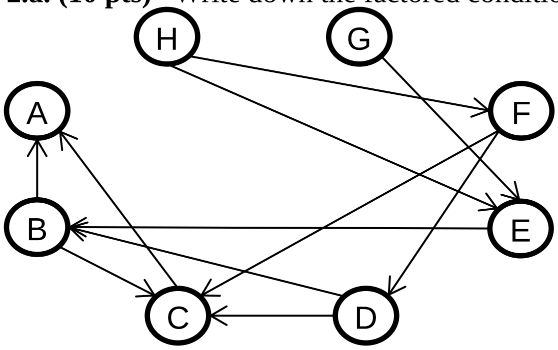
1.g (10 pts) ____ "Every butterfly likes some flower."
- A. ∀x ∃y [Butterfly(x) ∧ Flower(y)] ⇒ Likes(x, y)
- B. ∀x ∃y Butterfly(x) ∧ Flower(y) ∧ Likes(x, y)
- C. ∀x ∀y Butterfly(x) ∧ Flower(y) ∧ Likes(x, y)
- D. ∀x ∃y Butterfly(x) ⇒ [Flower(y) ∧ Likes(x, y)]

1.h (10 pts) ____ "Some butterfly likes some flower."
- A. ∃x ∃y Butterfly(x) ∧ Flower(y) ∧ Likes(x, y)
- B. ∃x ∃y [Butterfly(x) ∧ Flower(y)] ⇒ Likes(x, y)
- C. ∃x ∃y Butterfly(x) ⇒ [Flower(y) ∧ Likes(x, y)]
- D. ∀x ∀y Butterfly(x) ∧ Flower(y) ∧ Likes(x, y)

****** TURN PAGE OVER. QUIZ CONTINUES ON THE REVERSE. ******

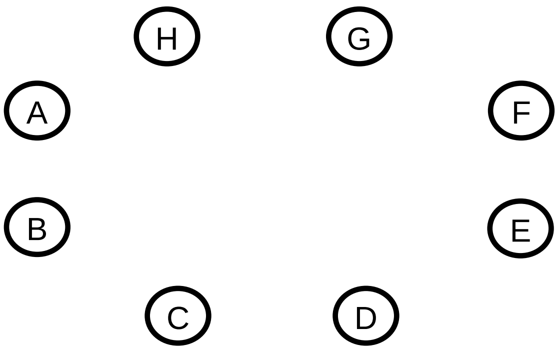
2. (30 pts total, 10 pts each) BAYESIAN NETWORKS.

2.a. (10 pts) Write down the factored conditional probability expression corresponding to this Bayesian Network:

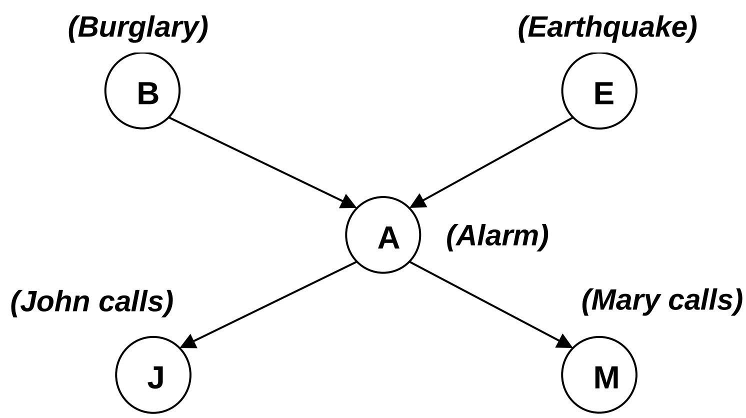


2.b. (10 pts) Draw the Bayesian Network corresponding to this factored conditional probability expression:

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)



2.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 $\wedge$ M=t $\wedge$ A=t $\wedge$ B=t $\wedge$ 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 $\wedge$ M=t $\wedge$ A=t $\wedge$ B=t $\wedge$ E=f)

[put symbolic here] =

[put numeric here] =

Scratch Paper

Scratch Paper