Spring 2025 CS 898 AW Assignment 1_1

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- **Any plagiarism found will result in zero marks for this assignment.**
- **Any AI Tools are welcome on this course. If you are using any AI Tools, please also show the prompts. If you are using AI Tools, and you DID NOT provide the prompts, you will end up with zero for this assignment.**
- **If your prompts are similar or exactly same as the given problem, you will end up with zero for this assignment.**
- A blackboard link will be created for submission.
- Only the electronic version will be accepted. Please scan your work, and do not simply take a picture of your work.
- If the TAs did not recognize your results, it will count as wrong.
- Please save your work in the following format "YOURWSUID_CS_898_AW_HW1_1.pdf". Other saving format will not be graded.
- The total marks for assignment 1_1 are 100 points.
- There are 10 multiple-choice problems. Q1-Q9 are worth 8 points per problem.
- Q10 is worth 28 points. Please make sure that you showed the solving process for Q10.

Q1.	Q2.	Q3.	Q4.	Q5.	Q6.	Q7.	Q8.	Q9.	Q10.
A	B	D	A	0.18	A	C	B	C	A

1. A fair coin is tossed. Please describe the sample spaces:
   A) {*Head, Tail*}
   B) {*Head, Tail, Head, Head*}
   C) {*Tail, Head, Tail, Head*}
   D) {*Trail, Tail*}

2. M&M sweets are of varying colors and the different colors occur in different proportions. The table below gives the probability that a randomly chosen M&M has each color, but the value for tan candies is missing.

Color	Brown	Red	Yellow	Green	Orange	Tan
Probability	0.3	0.2	0.2	0.1	0.1	?

   A) 0.125
   B) 0.1
   C) 0.145
   D) 0.113

3. From the Q2, what is the probability that you don't get either an orange one or a tan one?
   A) 0.75
   B) 0.45
   C) 0.9
   D) 0.8

4. Not all dice are fair. To describe unfair dice properly, we must specify the probability for each of the six possible outcomes. The following table gives answers for each of 4 different dice. Based on the following table. Please find out which one is valid.

Outcome	Dice 1 (A)	Dice 2 (B)	Dice 3 (C)	Dice 4 (D)
1	1/3	1/6	2/7	1/3
2	0	1/6	1/7	1/3
3	1/6	1/6	2/7	-1/6

4	0	1/6	1/7	-1/6
5	1/6	1/6	1/7	1/3
6	1/3	1/7	1/7	1/3

5. There are ten coins in a box, nine of them are fair, and one coin with two heads. If a student tosses the coin and it comes up heads, what is the probability that it is the coin with two heads?
   A)   0.47
   B)   0.55
   C)   0.67
   D)   0.54

6. Two events A and B are such that $P(A) = 0.5$, $P(B) = 0.3$, $and\ P(A \cap B) = 0.1$. Please compute the $P(B)$.
   A)   0.15
   B)   0.25
   C)   0.33
   D)   0.20

7. Based on Q6, what is the type of distribution of this $P(A, B)$:
   A)   random distribution
   B)   marginal distribution
   C)   joint distribution
   D)   Bayesian distribution

8. Based on Q6, please compute $P(A, B)$ if A and B are independent.
   A)   0.25
   B)   0.15
   C)   0.3
   D)   0.1

9. How many parent-nodes does node "Earthquake" have in the given Figure 1 Probability Graphic Model?
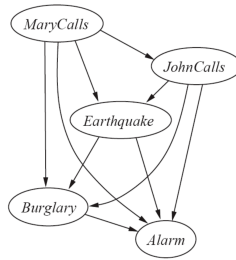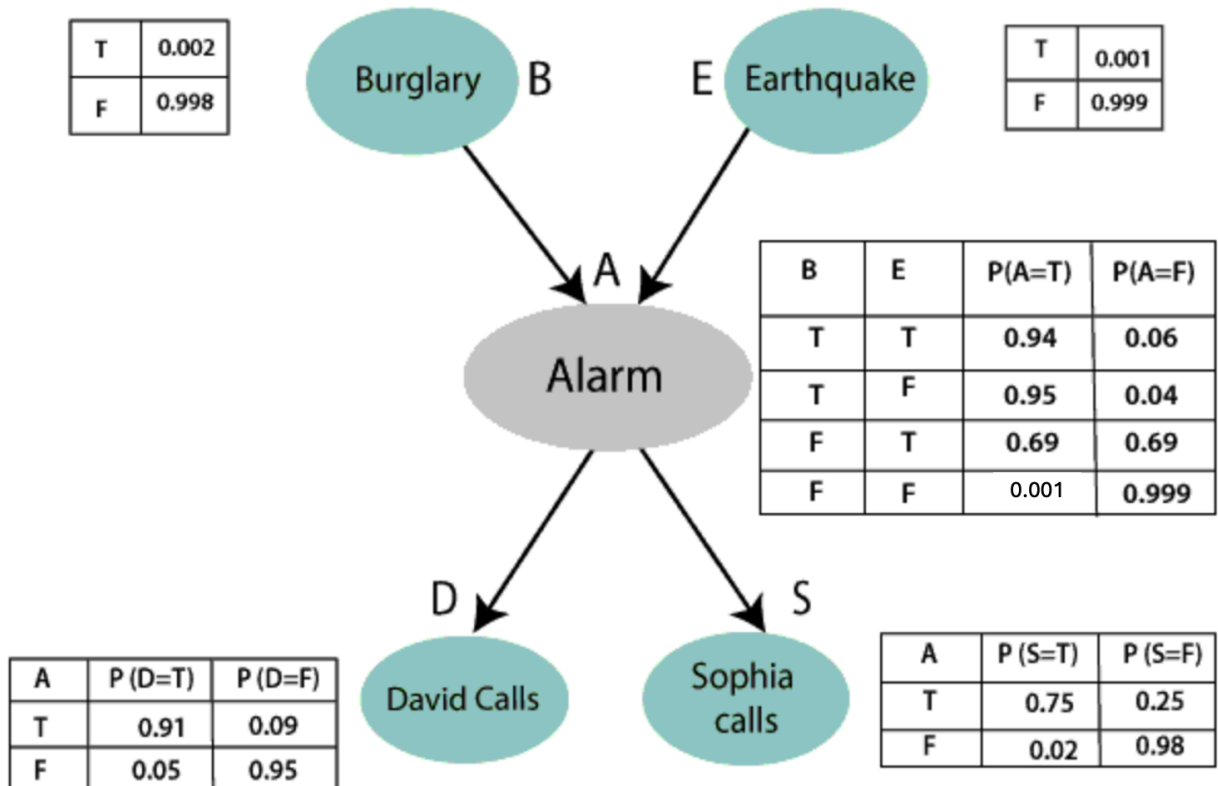   A) 0
   B) 1
   C) 2
   D) 3

Figure 1 Probability Graphic Model

10. Harry installed a new burglar alarm at his home to detect burglary. The alarm reliably responds at detecting a burglary but also responds for minor earthquakes. Harry has two neighbors David and Sophia, who have taken a responsibility to inform Harry at work when they hear the alarm. David always calls Harry when he hears the alarm, but sometimes he got confused with the phone ringing and calls at that time too. On the other hand, Sophia likes to listen to high music, so sometimes she misses to hear the alarm. Here we would like to compute the probability of Burglary Alarm. **Calculate the probability that alarm has sounded, but there is neither a burglary, nor an earthquake occurred, and David and Sophia both called the Harry.**

T	0.002
F	0.998

T	0.001
F	0.999

B	E	P(A=T)	P(A=F)
T	T	0.94	0.06
T	F	0.95	0.04
F	T	0.69	0.69
F	F	0.001	0.999

A	P (D=T)	P (D=F)
T	0.91	0.09
F	0.05	0.95

A	P (S=T)	P (S=F)
T	0.75	0.25
F	0.02	0.98

A) 0.00068045

B) 0.00067053
C) 0.068045
D) 0.00067053

⑩ Find $P(A|B=F, E=F)$ & $P(D \cap S=T|A)$

① $P(A|B=F, E=F) = 0.001$ (given by graph)

② $P(D \cap S=T|A=T) = P(D=T|A=T) \cdot P(S=T|A=T)$

$$= 0.91 \cdot 0.75$$

$$= 0.6825$$

①·② $= 0.001 \cdot 0.6825$

$$\boxed{= 0.0006683 \implies A}$$

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