Lab 3
CS114 Spring 2018
Probability Theory I: (Tabular) Probability Distribution Function: Joint, Conditional, and Marginal Probabilities

Exercises

1. Use the probability distribution function below to answer the questions. Show all of the calculation steps.

X	**Y**	**P(X,Y)**
Verb	Capitalized	0.1
Noun	Capitalized	0.25
Preposition	Capitalized	0.04
Adjective	Capitalized	0.03
Adverb	Capitalized	0.04
Verb	Not	0.3
Noun	Not	0.05
Preposition	Not	0.06
Adjective	Not	0.07
Adverb	Not	0.06

- Is the probability distribution above a valid probability distribution function? (Check the properties)
- What's the probability that a word is a capitalized adverb?
- Compute P(X = Preposition).
- Compute the probability that a word is a preposition given that we observe that the word is capitalized.
- Compute the probability that a word is not capitalized given that we observe that the word is an adjective.
- Prove or disprove that X and Y are independent.
- Use the Chain Rule to show that:
  P(W1,W2,W3,W4) = P(W4|W1,W2,W3) P(W3|W2,W1) P(W2|W1)P(W1)

2. Solve the following problem:

If X, Y, Z = {1, 2},
P(X=1|Z=1) = 0.4,
P(X=1|Z=2) = 0.4,
P(Y=1|Z=1) = 0.4,
P(Y=1|Z=2) = 0.5,
P(Z=1) = 0.4,
and X and Y are independent from each other,
calculate P(X=1, Y=2|Z=1).