Exercise Session 1

1 Joint Probability Distribution

a) Normalize such that the table represents the joint probability table of P(a, b) (with a a binary variable with domain $\{1, 2\}$ and b a discrete variable with domain $\{true, false, maybe\}$)?

b) Normalize such that the table represents the joint probability table of P(a, b, c) (with a, b and c binary variables with domain $\{true, false\}$)?

$$\begin{array}{c|cc} P(a,b,c=true) & b \\ true & false \\ \hline a & true & 0.3 & 0.5 \\ false & 0.2 & 0.3 \\ \end{array}$$

$$\begin{array}{c|c} P(a,b,c=false) & b \\ \text{true} & \text{false} \\ \hline a & \text{false} & 0.2 & 0.1 \\ \text{false} & 0.2 & 0.1 \end{array}$$

2 Continuous Probability Distribution

- a) Draw a rectangular continuous probability distribution.
- b) Draw a triangular continuous probability distribution.

3 Conditional Probability Distribution

a) Normalize such that the table represents the conditional probability table of P(a|b) (with a a binary variable with domain $\{1,2\}$ and b a discrete variable with domain $\{true, false, maybe\}$)?

b) Normalize such that the table represents the conditional probability table of P(a, b|c) (with a, b and c binary variables with domain $\{true, false\}$)?

$$\begin{array}{c|c} P(a,b|c=true) & b \\ true & false \\ \hline a & true & 0.3 & 0.5 \\ false & 0.2 & 0.3 \end{array}$$

4 Marginal Probability Distribution from Joint Probability Distribution

a) Calculate the marginal probability distribution p(b) from the normalized probability distribution calculated in question 1.a.

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b) Calculate the marginal probability distribution p(a, c) from the normalized probability distribution calculated in question 1.b.

5 Conditional Probability Distribution from Joint Probability Distribution

- a) Calculate the conditional probability distribution p(a|b) from the normalized probability distribution calculated in question 1.a.
- b) Calculate the conditional probability distribution p(b|a,c) from the normalized probability distribution calculated in question 1.b.

6 Independence

a) Fill in the question marks such that a and b are independent in the following probability distribution table.

$$P(a,b)$$
 true false maybe 0.2 0.1 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3

b) Fill in the question marks such that a and b are independent in the following probability distribution table.

$$P(a,b) egin{array}{ccccc} & b & & & & \\ true & false & maybe & & \\ \hline & 1 & 0.05 & 0.1 & 0.15 \\ a & 2 & ? & ? & ? & ? & \\ \end{array}$$

7 Conditional Independence

a) Fill in the question marks such that a and b are conditionally independent given c in the following probability distribution table.

P(a, b, c = true)		b			D(a, b)	o f alaa)	b	
		true	false	_	P(a, b, c = false)		true	false
	X	0.056	0.084	-		X	0.072	0.008
a	У	0.008	?		a	y	0.432	?
	${f z}$	0.016	?			${f Z}$	0.216	?

b) Fill in the question marks such that a and b are conditionally independent given c in the following probability distribution table.

P(a, b, c = true)		$ b \rangle$		D(a, b, a)	$-f_{\alpha}l_{\alpha\alpha}$	b	b	
		true	false	P(a, b, c = false)		true	false	
	X	0.056	0.084		X	0.072	?	
a	У	0.008	0.012	a	у	0.432	?	
	${f z}$	0.016	0.024		${f z}$	0.216	?	