Exercise Session 1

1 Joint Probability Distribution

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

$\mathrm{P}(a,b)$		b		
		true	false	maybe
a	1	0.1	0.5	0.3
	2	0.5	0.2	0.3

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

$\mathrm{P}(a,b,c = true)$		b	
		true	false
a	true	0.3	0.5
	false	0.2	0.3

$\mathrm{P}(a,b,c = false)$		b	
		true	false
a	true	0.2	0.1
	false	0.2	0.1

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 $\mathrm{P}(a|b)$ (with a a binary variable with domain $\{1, 2\}$ and b a discrete variable with domain $\{true, false, maybe\}$)?

$\mathrm{P}(a\|b)$		b		
		true	false	maybe
a	1	0.1	0.5	0.3
	2	0.5	0.2	0.3

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

$\mathrm{P}(a,b\|c = true)$		b	
		true	false
a	true	0.3	0.5
	false	0.2	0.3

$\mathrm{P}(a,b\|c = false)$		b	
		true	false
a	true	0.2	0.1
	false	0.2	0.1

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.

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)		b		
		true	false	maybe
	1	0.2	0.1	0.3
a	2	0,133	?	?

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

P(a, b)		b		
		true	false	maybe
	1	0.05	0.1	0.15
a	2	?	?	?

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	
		true	false
	x	0.056	0.084
a	y	0.008	?
	z	0.016	?

P$(a, b, c = false)$		b	
		true	false
	x	0.072	0.008
a	y	0.432	?
	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	
		true	false
	x	0.056	0.084
a	y	0.008	0.012
	z	0.016	0.024

P$(a, b, c = false)$		b	
		true	false
	x	0.072	?
a	y	0.432	?
	z	0.216	?