Advanced Artificial Intelligence, 2425

Workshop Task 1: Quiz - probability exercises

Question 1

10 points

Assume we have gathered the following statistics about student marks of a particular module:

Mark	1^{st}	2:1	2:2	3(pass)	Fail
Num Students	4	10	12	5	3

What is the probability of getting a 1st, with 4 decimals? Answer=[Blank 1]
What is the probability of getting a 2:1, with 4 decimals? Answer=[Blank 2]
What is the probability of getting a 2:2, with 4 decimals? Answer=[Blank 3]
What is the probability of getting a 3(pass), with 4 decimals? Answer=[Blank 4]
What is the overall probability of students passing the module (not to fail it), with 4 decimals? Answer=[Blank 5]

Blank 1

Blank 2

Blank 3

Blank 4

Blank 5

Question 2

5 points

Assume that we are only looking at whether students passed or failed a module. We have the following statistics per gender:

	pass	Fail
male	20	2
female	11	1

What is the probability of passing the module from this table, with 4 decimals? P(pass)=[Blank 1]
What is the probability of being female and passing, with 4 decimals? P(pass,female)=[Blank 2]

Blank 1

Blank 2

Question 3

10 points

Given the following joint probability table:

	sunny	rainy
hot	0.3	0.1
cold	0.1	0.5

Calculate the following conditional probabilities, with up to 3 decimals if needed:
P(sunny)=[Blank 1]
P(hot)=[Blank 2]
P(hot|sunny)=[Blank 3]
P(rainy|cold)=[Blank 4]

Blank 1

Blank 2

Blank 3

Blank 4

Question 4

15 points

Given the following probability distribution

X	Y	P(X,Y)
x	y	0.2
x	⌐y	0.3
⌐x	y	0.4
⌐x	⌐y	0.1

Calculate the following conditional probabilities, with up to 3 decimals if needed:

1. P(x ∧ y)=[Blank 1]
2. P(x)=[Blank 2]
3. P(x ∨ y)=[Blank 3]
4. P(y)=[Blank 4]

5. P(x|y)=[Blank 5]
6. P(¬x|y)=[Blank 6]
7. P(¬y|x)=[Blank 7]

Blank 1

Blank 2

Blank 3

Blank 4

Blank 5

Blank 6

Blank 7

Question 5

10 points

Given the following probability distribution

S	T	W	Probability
Summer	hot	sun	0.30
summer	hot	rain	0.05
summer	cold	sun	0.10
summer	cold	rain	0.05
winter	hot	sun	0.10
winter	hot	rain	0.05
winter	cold	sun	0.15
winter	cold	rain	0.20

Calculate the following conditional probabilities, with up to 3 decimals if needed:
P(sun)=[Blank 1]
P(sun|winter)=[Blank 2]
P(sun|winter,hot)=[Blank 3]

Blank 1

Blank 2

Blank 3

Question 6

10 points

Given the following probability distribution

Rash	Measles	P(X,Y)
r	m	P(r,m)=0.1
r	⌐m	P(r, ⌐m)=0.8
⌐r	m	P(⌐r,m)=0.01
⌐r	⌐m	P(⌐r, ⌐m)=0.09

What is the probability of not having measles given that a person has a rash? P(⌐m|r)=[Blank 1]
What is the probability of having measles given that a person has a rash? P(m|r)=[Blank 2]
Provide your answers with up to 3 decimals.

Blank 1

Blank 2

Question 7

15 points

Consider the following fictitious scientific information. Doctors find that people with the Kreuzfeld-Jacob disease (KJ) almost invariably ate hamburgers, thus P(HamburgerEater|KJ) = 0.9. The probability of an individual having KJ is rather low, about 1/100000. Assuming eating lots of hamburgers is rather widespread, say P(HamburgerEater) = 0.5, what is the probability that a hamburger eater will have the KJ disease? Calculate P(KJ|HamburgerEater) using the Bayes rule.

Question 8

25 points

Pat goes in for a routine health check and takes some tests. One test for a rare genetic disease comes back positive. The disease (d) is potentially fatal. She asks around and learns that rare means P(d)=1/10000. The test (t) is very accurate P(t|d) =0.99 and P(¬t|¬d) =0.95. Pat wants to know the probability that she has the disease. Calculate $P(d \mid t)$ using the Bayes rule.