Test XB_0031 2021 P2 Second Partial

Test ID: 110360
Folder: /Top/SIS/XB_0031
Folder description: Intelligent Systems
Version: 4.4
Randomised: No
Last modified: Thursday, 16 december 2021 14:06:00
Number of questons: 23
Blocks: Fixed
Display questions once: No
Tools: Calculator extended
Test time: 135 minutes
Maximum score: 62 pt.
Chance score: 10.44 pt. / 17%
In test set with: -

Test instruction

Exam duration: 1 HOURS 45 Minutes, unless you get 30 minutes extra time.

The following tools are permitted:
- Calculator
- Scrap paper (nothing written or printed on it)
- Check here for the cheat sheet

This second partial exam consists of 23 questions of varying complexity. In total you can reach maximally: 62 Points

There are 5 topics according to the main topics of lectures 8-13 (Set Theory, Calculating with Probabilities, Bayesian Networks, Machine Learning and Philosophy of Mind). For each topic, there are some simple reproduction questions (1 or 2 points), understanding questions (2 to 4 Points) and do-questions (3 to 6 Points).

Make sure you do not lose too much time on individual questions.

There will be no answers during the exam over the content. If you believe that something is ambigous (or even wrong), write down the question and get in contact with me after the exam. If you can make a reasonable case, you will get the points you deserve.

Multiple *Choice* questions have only **one** correct solution. In this case, the options are given by circles. **Multiple *Answers*** questions have one or more correct solution. In this case, the options are given by squares. The score of Multiple Answer questions is calculated automatically by the system as follows: Score = proportion good * (1 - proportion wrong * (1/a + (((n-k)/n)*(1-1/a))), where n is the total number of alternatives, k the number of correct answers and a a weighting factor set to 2. The more correct answers you give the more points you get, but wrong answers also count negatively.

Set Theory

Question order: Fixed

Question 1 − Set Theory: Disjoint Sets − 291325.1.0

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XB_0031/New questions - final exam 2021/2022
Answer option order: Random
Partial scoring: No
Maximum score: 1
Chance score: 0.25 pt. / 25%
Status:
Last modified: 14/12/2021 16:00
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Which is an example of disjoint sets?

A A={multiples of two} and B = {multiples of three}

B C = {whole numbers} and D = {rationalnumbers}

C E = {even numbers} and F = {odd numbers}

D G = {multiples of five} and H = {multiples of ten}

Question 2 − Set theory: Cardinality − 292179.2.1

Question type: Fill in (numerical)
Pre-test item: No
Folder: /Top/SIS/XB_0031/New questions - final exam 2021/2022
Answer option order: Fixed
Partial scoring: No
Maximum score: 2
Chance score: 0.00 pt. / 0%
Status:
Last modified: 16/12/2021 13:50
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Suppose we have |A| = 12, |B| = 17 and $|A \cup B| = 18$, what is the cardinality of the intersection of A and B, i.e. $|A \cap B|$?

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Question 3 − Set theory −−− non−empty not subset − 291142.1.1

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XB_0031/New questions - final exam 2021/2022
Answer option order: Random
Partial scoring: No
Maximum score: 2
Chance score: 0.50 pt. / 25%
Status:
Last modified: 15/12/2021 14:14
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Let A and B be two non-empty subsets of a set X such that A is not a subset of B, then for all A and B:

A A is a subset of the complement of B

B B is s subset of A

C A and B are disjoint

D A and the complement of B are non-disjoint

Probability Theory

Question order: Fixed

Question 4 − Uncertainty: Full Joint Distribution − 291333.2.0

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XB_0031/New questions - final exam 2021/2022
Answer option order: Random
Partial scoring: No
Maximum score: 2
Chance score: 0.50 pt. / 25%
Status:
Last modified: 15/12/2021 15:48
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Given the full joint distribution as in the below table. What is the vector of probability values for Toothache, given that cavity is true?
(Note: Normalize the values)

	toothache		¬ *toothache*	
	catch	¬ *catch*	*catch*	¬ *catch*
cavity	.108	.012	.072	.008
¬ *cavity*	.016	.064	.144	.576

A 0.2, 0.8

B 0.6,0.4

C 0.8,0.2

D 0.5,0.5

Question 5 − Uncertainty: dependent & independent pair of events − 291335.2.1

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XB_0031/New questions - final exam 2021/2022
Answer option order: Random
Partial scoring: No
Maximum score: 2
Chance score: 1.00 pt. / 50%
Status:
Last modified: 11/12/2022 17:54
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Consider the following scenario: you throw two fair die, one green and one red.
Are the following events dependent or independent?

1. The sum of the die is 5
2. The red die shows a 2

A Dependent

B Independent

Question 6 − Reasoning with Bayes' Rule − 293850.2.0

Question type: Multiple response
Pre-test item: No
Folder: /Top/SIS/XB_0031/New questions - final exam 2021/2022
Answer option order: Random
Partial scoring: Yes
Maximum score: 4
Chance score: 1.27 pt. / 32%
Status:
Last modified: 16/12/2021 13:58
Attributes: *Moeilijkheid/Difficulty 01 Gemiddeld/Average*
Taxonomie/Taxonomy 03 Toepassen/Apply

Given the following information:
- The probability that someone with a cold also has fever is 60%.
- The prior probability of having a cold is 0.001.
- More or less 1 out of 100 people in the population has fever.

I have fever. You want to calculate the probability that I have a cold using Bayes' rule. Which of the following statements is true? (multiple answers possible)

A P(cold|fever) = P(fever|cold) * P(cold) / P(fever) = 0.6 * 0.001 / 0.01 = 0.06

B P(cold|fever) = P(fever) * P(fever|cold) / P(cold) = 0.01 * 0.6 / 0.001 = 6

C The necessary information that P(cold) = 0.001, P(fever|cold) = 0.6 and P(fever)= 0.01 is given in the text.

D The calculation has to use a naive version of Bayes rule and assume conditional independence of fever and cold.

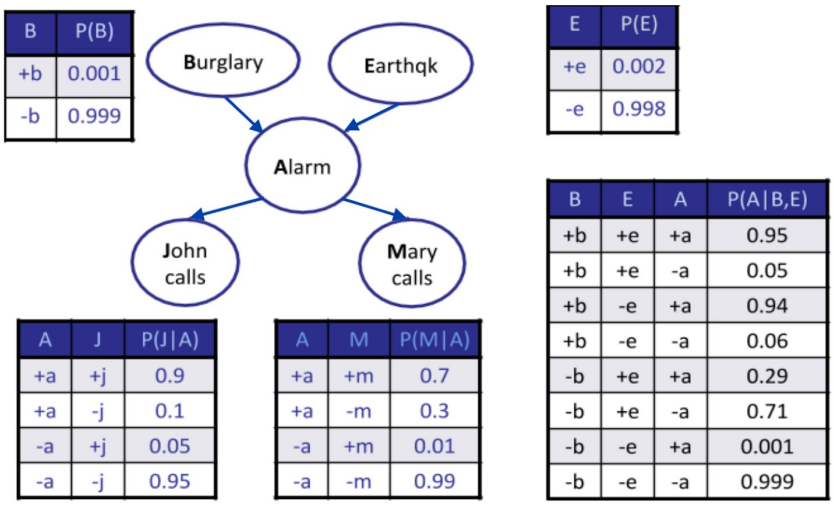
E P(cold|fever) < P(fever|cold)

F The probability cannot be calculated as P(cold|fever) is not provided in the text.

Question 7 − Bayesian network − 291145.3.2

Question type: Fill in (multiple)
Pre-test item: No
Folder: /Top/SIS/XB_0031/New questions - final exam 2021/2022
Answer option order: Fixed
Partial scoring: Yes
Maximum score: 4
Chance score: 0.00 pt. / 0%
Status:
Last modified: 16/12/2021 15:02
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Given the following Bayesian network, Please fill in the following blanks:



B	P(B)
+b	0.001
-b	0.999

E	P(E)
+e	0.002
-e	0.998

B	E	A	P(A|B,E)
+b	+e	+a	0.95
+b	+e	-a	0.05
+b	-e	+a	0.94
+b	-e	-a	0.06
-b	+e	+a	0.29
-b	+e	-a	0.71
-b	-e	+a	0.001
-b	-e	-a	0.999

A	J	P(J|A)
+a	+j	0.9
+a	-j	0.1
-a	+j	0.05
-a	-j	0.95

A	M	P(M|A)
+a	+m	0.7
+a	-m	0.3
-a	+m	0.01
-a	-m	0.99

a) The probability that there has been no burglary is [0.999]

b) The probability that the alarm has been activated if both earthquake and Burglary didn't occur is [0.001]

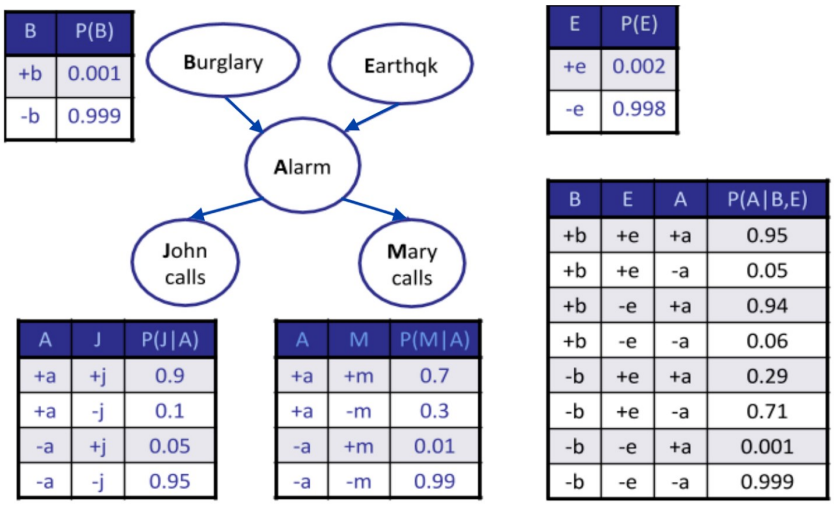
c) The probability John called if the alarm is activated is [0.9]

[Numeric]	[Numeric]	[Numeric]
0.999	**0.001**	**0.9**
		0.90

Question 8 – Bayesian network (advanced) – 292213.2.0

Question type: Fill in (multiple)
Pre-test item: No
Folder: /Top/SIS/XB_0031/New questions - final exam 2021/2022
Answer option order: Fixed
Partial scoring: No
Maximum score: 4
Chance score: 0.00 pt. / 0%
Status:
Last modified: 15/12/2021 14:48
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Given the following Bayesian network from the previous question, Please fill in the blank:



B	P(B)
+b	0.001
-b	0.999

E	P(E)
+e	0.002
-e	0.998

B	E	A	P(A|B,E)
+b	+e	+a	0.95
+b	+e	-a	0.05
+b	-e	+a	0.94
+b	-e	-a	0.06
-b	+e	+a	0.29
-b	+e	-a	0.71
-b	-e	+a	0.001
-b	-e	-a	0.999

A	J	P(J|A)
+a	+j	0.9
+a	-j	0.1
-a	+j	0.05
-a	-j	0.95

A	M	P(M|A)
+a	+m	0.7
+a	-m	0.3
-a	+m	0.01
-a	-m	0.99

This question requires some more calculation. Make sure you do not loose too much time on it.

What is the probability that the alarm has been activated, but neither burglary nor earthquake has occurred, and both John and Mary call?

(Hint: The full joint distribution is the product of the local conditional distributions $P(J \wedge M \wedge A \wedge \neg B \wedge \neg E)$) 0.000628

[Numeric]

0.000628

0.0006280

Machine Learning

Question order: Fixed

Question 9 − ML methods − 291339.1.3

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XB_0031/New questions - final exam 2021/2022
Answer option order: Random
Partial scoring: No
Maximum score: 1
Chance score: 0.25 pt. / 25%
Status:
Last modified: 15/12/2021 14:53
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

For a well-defined learning problem, what are important components that can influence the choice of model.

A The type of learning task.

B The type of feedback

C The type of available features

D All of the other options

Question 10 – ML Types: Supervised, Unsupervised – 291569.3.0

Question type: Fill in (multiple)
Pre-test item: No
Folder: /Top/SIS/XB_0031/New questions - final exam 2021/2022
Answer option order: Fixed
Partial scoring: Yes
Maximum score: 5
Chance score: 0.00 pt. / 0%
Status:
Last modified: 14/12/2021 19:26
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

What kind of model do we need for the following cases (**classification, regression, ranking, collaborative filtering, clustering**)?
First, indicate whether this would be **supervised or unsupervised** machine learning.

Example:
a) Searching for overlaps in the parts of the population affected by diabetes and arthritis.

unsupervised

clustering

a) Deciding if an MRI image shows a cancerous tumour or not.
supervised
classification

b) Twitter is a social networking site that allows micro-blogging services where people broadcast short, public messages refer as tweets. Twitter wants to find out about similar users.
unsupervised
clustering

c) Model to forecast the sales number based on the history of the sales.
Supervised
regression

d) Auto-categorizing the news provided by the News channel.
unsupervised
clustering

e) Suggesting a meal in the cafeteria self-order counter based on ratings of meals given by patients and hospital workers.
Supervised
collaborative

[Alphanumeric]	[Alphanumeric]	[Alphanumeric]	[Alphanumeric]	[Alphanumeric]
supervised	**classification**	**unsupervised**	**clustering**	**Supervised**
Supervised	Classification	Unsupervised	Clustering	supervised
[Alphanumeric]	[Alphanumeric]	[Alphanumeric]	[Alphanumeric]	[Alphanumeric]
regression	**unsupervised**	**clustering**	**Supervised**	**collaborative**
Regression	Unsupervised	Clustering	supervised	Collaborative

Question 11 − ML Evaluation : confusion matrix combination − 291604.1.1

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XB_0031/New questions - final exam 2021/2022
Answer option order: Random
Partial scoring: No
Maximum score: 1
Chance score: 0.25 pt. / 25%
Status:
Last modified: 16/12/2021 14:01
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Find out the wrong combination.

A True negative=correctly rejected

B False positive=correctly identified

C False negative=incorrectly rejected

D All of the mentioned

Question 12 − ML : Confusion Matrix − 291613.2.0

Question type: Fill in (multiple)
Pre-test item: No
Folder: /Top/SIS/XB_0031/New questions - final exam 2021/2022
Answer option order: Fixed
Partial scoring: Yes
Maximum score: 6
Chance score: 0.00 pt. / 0%
Status:
Last modified: 14/12/2021 19:20
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

A machine learning model categories given input into two classes “YES” or “NO”. The below table provides the actual class of the input and the predicted output from the model. Looking at the table solve the confusion matrix table. Calculate the true positive, false positive, true negative, false negative values, precision and recall for this classification.
Complete the below blank space with the correct value.

Actual Class	Predicted Class by model
NO	NO
YES	YES
YES	NO
YES	YES
NO	YES
YES	NO
YES	YES

		Actual Class	
Predicted Class		YES	NO
	YES	TP	FP
	NO	FN	TN

TP 3
FP 1
FN 2
TN 1
Precision 0.75
Recall 0.60

[Alphanumeric]	[Alphanumeric]	[Alphanumeric]	[Alphanumeric]	[Alphanumeric]
3	**1**	**2**	**1**	**0.75**
				0.750

[Alphanumeric]
0.60
0.6
0.600

Question 13 – ML : cross–validation – 291588.1.0

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XB_0031/New questions - final exam 2021/2022
Answer option order: Random
Partial scoring: No
Maximum score: 1
Chance score: 0.50 pt. / 50%
Status:
Last modified: 14/12/2021 17:54
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

A resampling procedure is used to evaluate machine learning models on a limited data sample for training referred to as Cross-validation. The resampling procedure has a single parameter called k that refers to the number of groups that a given data sample is to be split into. As such, the procedure is often called k-fold cross-validation. If k=8, then it will be 8-fold cross-validation.

A True

B False

Question 14 – ML: K–NN Distance Measure – 291607.2.2

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XB_0031/New questions - final exam 2021/2022
Answer option order: Random
Partial scoring: No
Maximum score: 1
Chance score: 0.17 pt. / 17%
Status:
Last modified: 11/12/2022 17:48
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Which of the following distance measure can we use in the case of categorical (having finite number of categories or distinct groups) in k-NN?

1. Hamming Distance
2. Euclidean Distance
3. Neighbourhood Distance
4. Regression Distance

A 1

B 2 and 3

C 1 and 4

D 1 and 2

E 1, 2 and 3

F All of them

Question 15 – Text Features: preprocessing – 291616.2.0

Question type: Multiple response
Pre-test item: No
Folder: /Top/SIS/XB_0031/New questions - final exam 2021/2022
Answer option order: Random
Partial scoring: Yes
Maximum score: 1
Chance score: 0.31 pt. / 31%
Status:
Last modified: 15/12/2021 16:11
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Which of the following techniques can be used to pre-process textual information in feature vectors used to determine similarity between texts.

A Lemmatization
B Stemming
C Grounding
D Syllabisation
E Discretisaton

Question 16 – Feature Vector : Nearest Neighbour – 291618.2.0

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XB_0031/New questions - final exam 2021/2022
Answer option order: Random
Partial scoring: No
Maximum score: 2
Chance score: 0.50 pt. / 25%
Status:
Last modified: 14/12/2021 19:20
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Given the three feature vectors:
1. <1,1,1,1,1,0,0,1,0,0>
2. <0,1,1,0,0,1,1,1,0,0>
3. <0,1,0,1,1,0,0,0,1,1>

Which vector represents the nearest neighbour of the below vector.
<0,1,0,0,1,1,0,1,0,0>

If we apply Euclidean distance?

A 1
B 2
C 3
D None of them

Question 17 − Naive Bayes classification − 292265.2.1

Question type: Multiple response
Pre-test item: No
Folder: /Top/SIS/XB_0031/New questions - final exam 2021/2022
Answer option order: Random
Partial scoring: Yes
Maximum score: 4
Chance score: 1.25 pt. / 31%
Status:
Last modified: 15/12/2021 15:27
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Observations have been made about the weather, the clarity of explanation and happiness of individual students.

	Sunny	Rainy	Windy	Comprehensive expl.	Label - happy
D1	Y	N	N	Y	Y
D2	N	Y	Y	N	Y
D3	N	Y	N	Y	Y
D4	N	Y	Y	N	N
D5	Y	Y	Y	Y	N

Use Naive Bayes classification to estimate whether the student will feel happy or not on a day with no sun and no rain, although windy and attending a good
explanation? Which of the statements is true?

A Naive Bayes (with smoothing of adding a value of 0.02) will predict that the student will feel happy.

B Naive Bayes (with smoothing of adding a value of 0.02) will predict that the student will feel NOT happy.

C The prior probability P(Label-happy=Y) is 2/3

D The prior probability P(Label-happy=Y) is 3/5

E The conditional probablity P(Sunny|Label-happy=Y) is 2/3

F The conditional probablity P(Sunny|Label-happy=Y) is 1/3

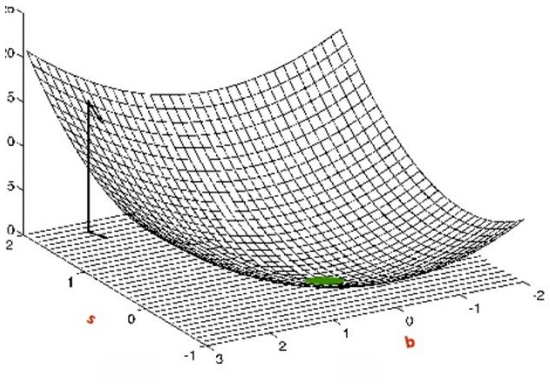
G With Naive Bayes we predict that Label-happy=Y if P(Label-happy=Y|-sun,-rain,+w,+e) > P(Label-happy=N|-sun,-rain,+w,+e)

H With Naive Bayes we predict that Label-happy=Y if P(-sun,-rain,+w,+e | Label-happy=Y) > P(-sun,-rain,+w,+e | Label-happy=N)

Question 18 − Model space MC − 205100.1.2

Question type: Multiple response
Pre-test item: No
Folder: /Top/SIS/XB_0031/New questions - final exam 2020/2021/Questions machine learning
Answer option order: Random
Partial scoring: Yes
Maximum score: 3
Chance score: 0.92 pt. / 31%
Status:
Last modified: 17/12/2020 20:14
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

In the following image, also shown in the lecture, the green point is identified as the optimal solution to a learning problem.



Which of the following statements are true? (multiple answers are possible).

A The green point refers refers to the linear function with the lowest error rate (the one that fits a particular learning model best according to the training data)

B The green point refers to the point in the binary vectorspace with the best training example (the one that fits a particular learning model best)

C The third dimension (orthogonal to s and b) shows the error rate for a linear separator function, eg. f(x) = sx+b.

D The green point is the point where f(x) = sx+b reaches a minimum, ie where the linear separator reaches the lowest point (in other words, f(x)=0

E The third dimension (orthogonal to s and b) enumerates all possible linear separators, so that the green point is the optimal one (as it is the lowest).

F There are two ways to find the best machine learning model in this scenario: either we analytically find the green point as the point where the derivation of the error function is 0, or we apply gradient descent as a search method to move step by step to the green point. (Gradient descent is a local search similar to hill-climbing)

G With a Neural Network we can predict the value of the 3rd dimension (orthogonal to s and b on the x and y axis) given the representation of the features according to variables s and b.

Question 19 − Regression − 292316.1.1

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XB_0031/New questions - final exam 2021/2022
Answer option order: Random
Partial scoring: No
Maximum score: 4
Chance score: 0.67 pt. / 17%
Status:
Last modified: 16/12/2021 14:15
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

This exercise is about Regression.

Let us try to fit a linear function to a number of training sets where the slope s is known to be 1.

Suppose we have three pairs of values (1,0), (2,0) and (3,1) for two features. What is the optimal fitting function in this model class (so minimises the error rate)?

A f(x)= x - 5/3

B f(x)= x - 3/5

C f(x)= x + 5/3

D f(x)= x + 3/5

E There is no optimal fitting function

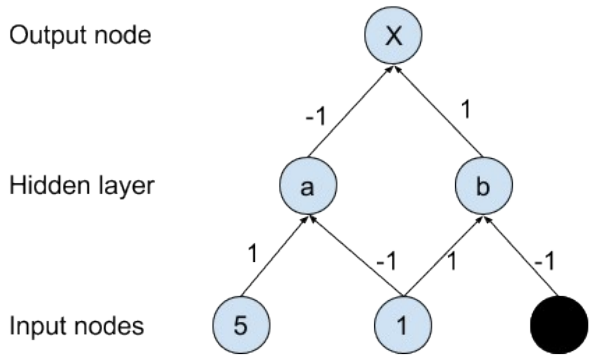
F Neither of the functions in the other options is the optimal fitting function, but there exist one.

Question 20 − Neural Network calculation − 85389.1.0

Question type: Fill in (numerical)
Pre-test item: No
Folder: /Top/SIS/XB_0031/New questions - final exam 2021/2022
Answer option order: Fixed
Partial scoring: No
Maximum score: 4
Chance score: 0.00 pt. / 0%
Status:
Last modified: 25/01/2019 13:49
Attributes: *Moeilijkheid/Difficulty* *01 Gemiddeld/Average*
Taxonomie/Taxonomy *02 Begrip/Understand*

Here, we see a basic multilayer feedforward neural network, with weights and values on the input nodes. It has no activation function (all nodes are *linear*). The black node is a bias node with value 1.

What is the value on the output node (marked X)?



-4

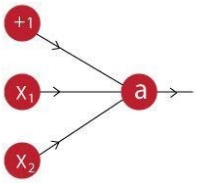
Question 21 – Neural Network : AND Function – 291623.3.0

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XB_0031/New questions - final exam 2021/2022
Answer option order: Random
Partial scoring: No
Maximum score: 4
Chance score: 1.00 pt. / 25%
Status:
Last modified: 15/12/2021 15:13
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

(Advanced) Do not loose to much time of this question.

Let us assume we implement an AND function to a single neuron. Below is a tabular representation of an AND function:

X1	X2	X1 AND X2
0	0	0
0	1	0
1	0	0
1	1	1



The activation function of our neuron is denoted as:

$$f(x) = \begin{cases} 0, & for\ x < 0 \\ 1, & for\ x \geq 0 \end{cases}$$

This just means that node a returns a 0, if its value is smaller than 0, and a 1 otherwise.

Which of the following weights of this network would implement such a logical AND function as defined in the table?

A b = -1.5, w1 = 1, w2 = 1

B b = 1.5, w1 = 2, w2 = 2

C b = 1, w1 = 1.5, w2 = 1.5

D None of these

Philosophy of Mind

Question order: Fixed
There will be two questions related to Philosophy of Mind.

Question 22 – Philosophy of mind: Libbet's experiment – 291785.2.0

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XB_0031/New questions - final exam 2021/2022
Answer option order: Random
Partial scoring: No
Maximum score: 2
Chance score: 0.50 pt. / 25%
Status:
Last modified: 15/12/2021 14:35
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Libbet's experiment (about the timing of the intention for an action and the corresponding brain/muscle activity for the action) shows that (one answer is correct)

A our conscious intention for an action is not the cause of that action

B our conscious intention for an action is subjective

C we adjust our intentions to what we are instructed to do

D we don't really have intentions, we just ascribe them to each other

Question 23 – Philosophy of mind: Turing Test – 291779.3.0

Question type: Multiple response
Pre-test item: No
Folder: /Top/SIS/XB_0031/New questions - final exam 2021/2022
Answer option order: Random
Partial scoring: Yes
Maximum score: 2
Chance score: 0.60 pt. / 30%
Status:
Last modified: 15/12/2021 14:35
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Which of these are reasonable objections to the Turing test (multiple answers possible)

A it is 70 years old, so it no longer applies to modern AI

B it imposes a white male dominant view on the notion of intelligence

C it uses human intelligence as the standard for intelligence

D it degrades humans by comparing them to machines