Data Mining Homework Set 4, 2020

Cursus: BETA-INFOMDM Data Mining (INFOMDM)

Aantal vragen: 4

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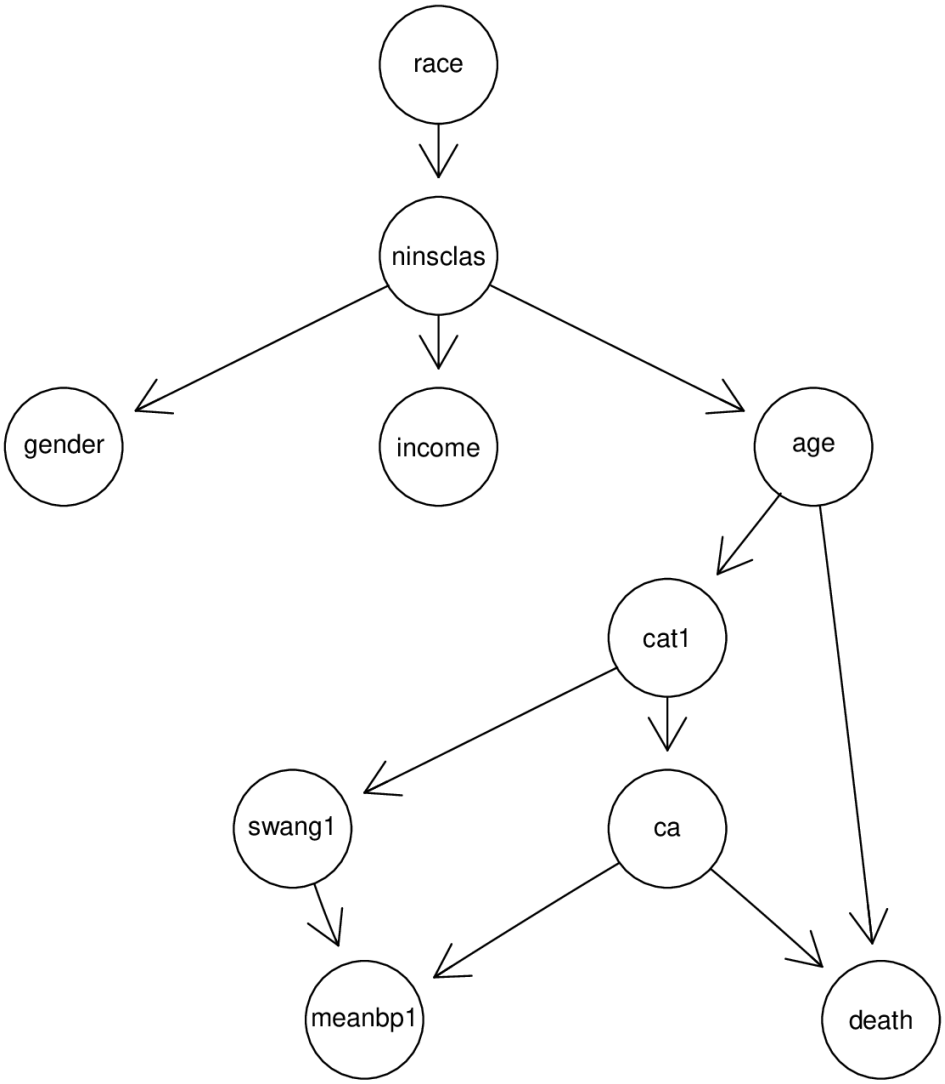
Welcome!

Aantal vragen: 4

1 Consider the following Bayesian network constructed on data from an intensive care unit:

2 pt.



Which of the following conditional independence properties are true according to the given model? (0 or more answers may be correct)

a. gender ⊥ income | ninsclas

b. ca ⊥ age | cat1

c. ca ⊥ age | {cat1, death}

d. meanbp1 ⊥ cat1 | {swang1, ca}

2 The table below shows the number of successes and failures for minor and major operations in two hospitals: one academic hospital and one local hospital. The total number of operations is n = 2900.

		RESULT	RESULT
OPERATION	HOSPITAL	success	failure
minor	academic	685	15
	local	584	16
major	academic	1425	75
	local	93	7

The Bayesian network we want to fit to the data contains the following edges: OPERATION → RESULT, and HOSPITAL → RESULT.

Compute the maximum likelihood estimates of the following parameters (round your answer to two decimal places):

P(OPERATION = minor): **a.** ..(1 pt.)

P(RESULT = success | OPERATION = major, HOSPITAL = academic): **b.** ..(1 pt.)

The total number of parameters of the given Bayesian network is: **c.** ..(1 pt.)

3 For the data, please refer to exercise 2 of this set.

We perform a greedy hill-climbing search to find a good Bayesian network structure. Neighbour models are obtained by adding a single edge to the current model, deleting a single edge, or turning a single edge around. We start the search process from the empty graph (the mutual independence model).

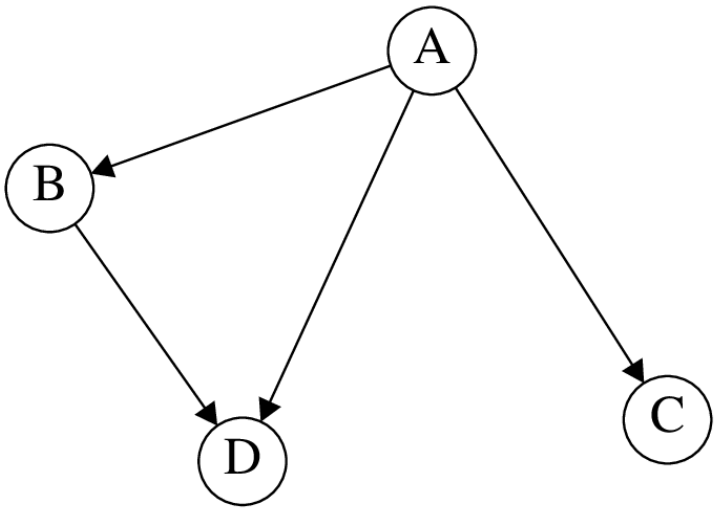
In your calculations, always use the natural logarithm. Round your answers to two decimal places.

The contribution of the node RESULT to the log-likelihood score of the current (mutual independence) model is: **a.** .....(1 pt.)

The change in log-likelihood score (Δ score) if we add the edge OPERATION → RESULT to the current model is: **b.** .....(1 pt.)

The change in BIC-score if we add the edge OPERATION → RESULT to the current model is: **c.** .....(1 pt.)

4 We perform a greedy hill-climbing search to find a good Bayesian network structure on 4 variables
2 pt. denoted A,B,C, and D. Neighbour models are obtained by adding, deleting, or reversing an edge. We start the search process from the following initial graph:



In step 1 of the search we find that deleting the edge A → B gives the biggest improvement in the BIC score. Assume that Δ scores of operations computed in previous iterations that are still valid are not recomputed, but are retrieved from memory. All other Δ scores need to be computed!

For which operations (addition, deletion, reversal of an edge) do we need to compute the Δ score in step 2 of the search? (0 or more answers may be correct)

a. Add C → B

b. Add B → A

c. Add D → C

d. Reverse B → D

Thank you. Goodbye!