50.007 Machine Learning HW 5

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Q1.

X1 and X6 are independent.

X1 and X6 are independent given X5

X1 and X6 have induced dependence given X10

Q2.

No. Effective parameters = 1(X1) + (2\*1)(X2) + (2\*1)(X3) + (2\*1)(X4) + (2\*1)(X5) + 1(X6) + (2\*1)(X7) + (2\*1)(X8) + (2\*2\*2\*1)( X9) + (2\*1)(X10) + (2\*1)(X11) = 26

if node X3, X8 and X9 can take 5 different values: {1, 2, 3, 4, 5}, and all other nodes can only take 4 different values: {1, 2, 3, 4},

No. effective parameters = 3(X1) + (4\*3)(X2) + (4\*4)(X3) + (5\*3)(X4) + (4\*3)(X5) + 3(X6) + (4\*3)(X7) + (4\*4)(X8) + (4\*4\*5\*4)( X9) + (5\*3)(X10) + (4\*3)(X11) = 436

Q3.

Q4.

1. We can use the maximum likelihood estimation method for nodes X7 and X9.

From the MLE, the node tables are

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  | ¼ | 3/4 |
|  | 6/8 | 2/8 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  | |
| 1 | 2 |
| 1 | 1 | 1 | 1/3 | 2/3 |
| 1 | 1 | 2 | 1 | 0 |
| 1 | 2 | 1 | 1 | 0 |
| 2 | 1 | 1 | 1 | 0 |
| 2 | 2 | 1 | 1 | 0 |
| 2 | 1 | 2 | 0 | 1 |
| 1 | 2 | 2 | ½ | ½ |
| 2 | 2 | 2 | 0 | 1 |