**Part I [50 points]: Learning Conditional Probability Tables**

**Task 1 [25 points]**

Run by running the main method of solution, with the first parameter as the filename stored under ./data / and the second parameter as “Task1”.

**Task 2 [10 points]**

The likelihood and log likelihood are the final two lines of the files created by task 1.

**Task 3 [15 points]** - Comparison of the likelihood and log-likelihood results.

*Please run the program you've written for Task-1 and Task-2 on each training data set.*

Files are stored under: ./solutions/cpt-CPTNoMissingData-d\*

*Please write the likelihood and log-likelihood of the CPT for each training data set.*

|  |  |  |
| --- | --- | --- |
| **Filename** | **Likelihood** | **Log Likelihood** |
| cpt-CPTNoMissingData-d1 |  | -24.61840455051596 |
| cpt-CPTNoMissingData-d2 |  | -154.58093093434522 |
| cpt-CPTNoMissingData-d3 |  | -Infinity |

*Please explain how the likelihood and log-likelihood measure of the Bayesian Network differs as the number of training data set increases.*

*Please explain how the likelihood and log-likelihood measure of the Bayesian Network differs as the number of variables (nodes) increases.*

*Please write a short discussion on how the likelihood and log-likelihood measure will differ when the possible values of each variable increases.*

**Part II [50 points]: Learning Structure and Conditional Probability Tables**

**Task 4 [25 points]**

Run by calling function, which takes parameters one, two and three.

**Task 5 [7 points]**

Please experiment with the scoring function by changing the constant parameter. For each parameter, please run the program you’ve written for Task-4 on each data set. For each data set and each parameter, please write the score function of the final Bayesian Network. Please explain how the final Bayesian Network changes as the parameter increases/decreases.

Well if you have a negative constant you will value complexity very highly. The formula for the score is:

score=log-likelihood−*C*∗*E*

So if you have a negative C you will actually end up increasing the score as the network gets more complex.

**Task 6 [8 points]**

Please implement “no edge” and “random chain” to initialize the structure. Please run the Bayesian Network generation program (Task-4) with these two initialization methods on each data set and compare the final Bayesian Network (in terms of the scoring function and structural complexity) after 3 minutes searching time.

**Task 7 [10 points]**

Please implement the “best tree network” to initialize the structure, and compare the final Bayesian Networks results with the Bayesian Networks generated with “no edge” and “random chain” initialization method (Task-6), in a similar manner as in Task-6.