**REPORT**

**Independent Bayesian Networks:**

This method just assumes that there is no relation between the features and is just solely based on the marginal probabilities of those features.

The loglikelihood of the test data for this method is the worst of all the cases for all datasets.

**Chow-Liu Tree:**

This algorithm performs slightly better than the previous one because the tree that is constructed is based on the mutual information matrix which gives a good measure of the dependence of the factors on each other.

**Mixture of trees using EM:**

This method performs the best among all methods for all the datasets. The EM algorithm work very well because of the large number of epochs.  
The values of K[2, 3, 4] were found out by testing on the validation set for each dataset by checking their loglikelihood on the validation set.  
**The values have been input as a dictionary of key value pairs where keys are the dataset name and the values are the K values.**The validation set testing code has been commented out.

**Random forest style approach for Mixture of trees:**

This method gives good likelihood scores too but not as good as the mixture of trees method.   
The best value for the hyperparameters (K[3, 4], R[5, 6, 7]) were found by testing on the validation set. This algorithm works well because of the bootstrapping.

**These values have been passed as a dictionary of key-value pairs where keys are the dataset name and the values are a list containing optimal (K, R) for each dataset.**

The validation set testing code has been commented out.

**Extra credit:**

Another way to set the weight for choosing each mixture model instead of 1/k is weighting them according to the likelihood on the train set. The likelihood values on the train set for each mixture tree was calculated and then normalized to act as weight for the respective tree mixture variables. This gives better performance and makes sense as the mixture tree with more likelihood should have more weight while generating the likelihood of the test set.

**Ranking:** 1) Mixture of trees using EM 2) Random forest style approach for mixture of trees 3) Chow-Liu trees 4) Independent Bayesian Networks

Based on the observations above, the ranking makes sense.