**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI**

Batch No. :

**DEPARTMENT OF COMPUTER SCIENCE AND INFORMATION SYSTEMS**

**Artificial Intelligence (BITS F444/ CS F407)**

**I Semester 2017-18**

**Programming Assignment-5**

**Coding Details**

**(November 28, 2017)**

*Instruction: Type the details precisely and neatly*

1. ID 2015A7PS0102P

Name K S Sanjay Srivastav

1. Mention the names of Submitted files :
   1. 2015A7PS0102P.docx
   2. driver.py
   3. modules.py
   4. GUI.py
   5. input1.txt
   6. input2.txt
   7. input3.txt
2. Total number of submitted files: 7
3. Name of the folder : 2015A7PS0102P
4. Have you checked that all the files you are submitting have your name in the top?(yes/no) yes
5. Have you checked that all the files you are submitting are in the folder as specified in 4 (and no subfolder exists)?(yes/no) yes
6. Modules implemented
   1. Created the Bayesian network? (yes/no) yes
   2. Created Markov blanket?( yes/no) yes
   3. Created expression from the inputs read ?(yes/no) yes
   4. Computed probability ? (yes/no) yes
7. Data structures used
   1. To represent the Bayesian network: A Class **BayesianNetwork,** which stores all the nodes in the network.
   2. To represent Markov blanket: A Class **MarkovBlanket,** which stores the name of the node, list of all the parent nodes of it, list of Children nodes of it and a list of Parents of Children nodes other than the given node.
   3. To represent the variables: A Class **node** which stores the name of the node, the parent nodes and children nodes as attributes. It also stores the links between these nodes. Also probability is stored in the form of a list.
   4. To represent the expression for probabilistic query: A Class **expression,** which has two lists of query variables’ and condition variables’ names as attributes.
8. Implementation Details
   1. How did you create the CPT reading the data from the file? For every node first the input is read and nodes without any links to parents are created. Also their probabilities are inserted in the order read from the file into a list. Later, the parent nodes and child nodes are added for each node.
   2. How did you access the BN to obtain the Markov blanket? For each Markov Blanket, the entire network is sent. Every node has its parents and children stored as attributes. Since the network has connections, entire connected sub-graph of the network was accessible.
   3. How did you access the CPTs? Using the state of the parents in each of the joint probability to be computed, either 1 or 0 was bit-wise left shifted for each parent giving the correct index in the cpt.
   4. How did you expand the expression for the conditional dependence on variables? Using the formula P(A|B)=P(A,B)/P(B) and the rule that each node is independent of every other node other than its Markov Blanket. Also the rule P(x1,x2,x3,…,xn)= was used.
   5. How did you marginalize the expression? Using a method “**allposs**” which generates all 2^n combinations of a given list of variables of size n and returns this new list which has all the positive and negative form of each variable. All these combinations’ probabilities were calculated separately and summed up.
   6. How many terms does a query have? Give example. Each of query and condition list can have a maximum of 10 terms, but since the maximum size of the network assumed is 15, only 15 terms (query + condition) are possible. Ex: P(D|A,B,C,¬L) = 0.61
9. Graphics: Created the graphics (yes/no) yes
10. Output
    1. Execute your program to answer the following probabilistic queries. Mention the answer obtained by your program. Also compute the Markov blanket of the variable A.

* P(D, A, L| R, X, P, O) = 0.0997432867636
* P(A)= 0.227587680582
* P(F,R|A,P)= 0.128149583593
* P(D)= 0.472122546785
* P(D|P)= 0.50652782668
* P(A|Y, C)= 0.0489561897357
* P(A,D|O,R,P)= 0.224232103788
* Markov Blanket of A: Node: A, Parents =G,X,N,H, Children= D,F,Y,C, Parents of Children= B,L

1. Compilation Details:
   1. Code Compiles (Yes/ No): Yes
   2. Mention the .py files that do not compile: None
   3. Any specific function that does not compile: None
   4. Ensured the compatibility of your code with the specified Python version(yes/no) yes
   5. Instructions for compilation of your files mentioning the multi file compilation process used by you (We may use the replica of these for compiling your files while evaluating your code) python driver.py
2. Driver Details: Does it take care of the options specified earlier(yes/no):yes
3. Execution status (describe in maximum 2 lines) The code takes input, a file name and gives the GUI asking to click the query and condition variables. Once the user clicks the “Click to Process the query”, it generates the expression. Once the processing is done, answer is displayed and it asks for a new query. Here it is assumed that the input file will have at the maximum 15 lines as the GUI is static and will only work if the number of nodes are less than 16.
4. Declaration: I, K S Sanjay Srivastav (name) declare that I have put my genuine efforts in creating the python code for the given programming assignment and have submitted only the code developed by me. I have not copied any piece of code from any source. If the code is found plagiarized in any form or degree, I understand that a disciplinary action as per the institute rules will be taken against me and I will accept the penalty as decided by the department of Computer Science and Information Systems, BITS, Pilani.

ID 2015A7PS0102P Name: K S Sanjay Srivastav

Date: 28-11-2017

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