**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 \_\_\_\_\_\_\_\_\_\_2014A7PS0095P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Name \_\_\_\_\_\_\_\_\_Lakshit Bhutani\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Mention the names of Submitted files :
   1. 2014A7PS0095P.docx
   2. driver.py
   3. graph.py
   4. gui.py
   5. blanket.py
   6. query.py
   7. input1.txt
2. Total number of submitted files: \_\_\_\_7\_\_\_\_
3. Name of the folder :\_\_\_\_\_2014A7PS0095P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
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:\_\_\_Bayesian network is stored as collection of objects of class Node which contains the node name, list of parents and children and conditional probabilities\_\_\_\_\_\_\_\_\_\_\_
   2. To represent Markov blanket:\_\_\_\_Markov blanket of a variable is stored as a list \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. To represent the variables:\_\_\_\_\_Bayesian network node represents a variable which is an instance of class Node\_\_\_\_\_\_\_\_
   4. To represent the expression for probabilistic query:\_\_\_\_Two lists, one each for query and conditional variables which store the positive, negative or absence of each variable in the expression\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. Implementation Details
   1. How did you create the CPT reading the data from the file?

The order of parents as well as the list of probabilities in order were stored as part of variable Node. Each row can be accessed using appropriate index in the probability list.

* 1. How did you access the BN to obtain the Markov blanket?

Markov blanket contains the node itself, parents, children and parents of its children. Node itself and parents are available in the Node object. Children list was populated in bottom up fashion by graph traversal. Hence both children and children’s parents information obtained.

* 1. How did you access the CPTs?

Negation of a variable is represented as bit 0 and presence as bit 1, hence bitmask constructed and corresponding probability from probability list accessed.

* 1. How did you expand the expression for the conditional dependence on variables?

P(X | E) = P(X1, X2, … , Xn | E1, E2, …, Em) = P(X1, X2, … , Xn , E1, E2, …, Em) / P(E1, E2, .. , Em)

* 1. How did you marginalize the expression?

To compute P(X1, X2, …, Xn), and given ordering of variables *order,* if order[0] has assignment in X1, X2, …, Xn then corresponding P(order[0] | parents(order[0]) times the rest of the probability in order[1:] else taking both assignments of order[0] multiplied with the rest of the probability and finally summing them.

* 1. How many terms does a query have? Give example.

1. Graphics: Created the graphics (yes/no)\_\_\_\_\_YES\_\_\_\_\_\_\_
2. 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 = A, B, C, D, F, G, H, L, N, X, Y

1. Compilation Details:
   1. Code Compiles (Yes/ No):\_\_\_\_\_Yes\_\_\_\_\_\_\_\_\_
   2. Mention the .py files that do not compile:\_\_\_\_\_\_\_\_\_\_\_\_\_NA\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. Any specific function that does not compile:\_\_\_\_\_\_\_\_\_\_\_\_\_NA\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   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)

Code computes both markov blanket and probability of any expression using GUI

1. Declaration: I, \_\_\_\_\_\_\_Lakshit Bhutani\_\_\_\_\_\_\_\_\_\_ (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\_\_\_\_\_\_\_2014A7PS0095P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Name: Lakshit Bhutani\_\_\_\_\_

Date: \_\_\_28 – 11 - 2017\_\_\_\_\_\_\_\_\_\_\_

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