**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 : 2015A7PS0116P

Name : Abhishek V Joshi

1. Mention the names of Submitted files :
   1. 2015A7PS0116P.docx
   2. bayes\_net\_definitions.py
   3. GUI.py
   4. read\_file.py
   5. input.txt
2. Total number of submitted files: 5
3. Name of the folder : 2015A7PS0116P
4. Have you checked that all the files you are submitting have your name in the top? 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
6. Modules implemented
   1. Created the Bayesian network? : yes
   2. Created Markov blanket? : yes
   3. Created expression from the inputs read? : yes
   4. Computed probability? : yes
7. Data structures used
   1. To represent the Bayesian network: Graph
   2. To represent Markov blanket: Graph (Sub-graph) (Adjacency List implemented using a Python list)
   3. To represent the variables: Strings
   4. To represent the expression for probabilistic query: `Expr` class (Both the query and conditional variables are stored as a list of Strings)
8. Implementation Details
   1. How did you create the CPT reading the data from the file?

→ Parsed the strings in the file to identify separate entities, representing variables and probabilities. Generated combinations of `True` and `False` depending upon the number of parents of a node in ascending order (i.e. 00 01 10 11 for 2 parents) and mapped these `True-False` tuples to the respective probabilities.

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

→ Obtained the node using it’s name (e.g. node `A`) by using a linear search in the list of nodes of the network. Used the parents and children relations stored in the nodes to obtain the Markov Blanket.

* 1. How did you access the CPTs?

→ CPT’s are mapped to their values using the Dictionary Data Structure provided by python (which internally is a hashtable). Hence passing the keys is suffice to access the CPT’s.

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

→ The expression’s representation was expanded using recursive calls on current probability distribution.

* 1. How did you marginalize the expression?

→ Marginalization was done using the `sum()` method of python on a list obtained by accessing the CPTs correctly.

* 1. How many terms does a query have? Give example. A query can have at most 20 terms (10 each of query and conditionals). e.g. Expr(‘B ~O L A’, ‘G ~C ~D’) ; where the first string is the set of query variables and the other one is a set of conditional variables

1. Graphics: Created the graphics? : 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) = 0.094
* P(A)= 0.241
* P(F,R|A,P)= 0.127
* P(D)= 0.48
* P(D|P)= 0.501
* P(A|Y, C)= 0.057
* P(A,D|O,R,P)= 0.222
* Markov Blanket of A= [‘A’, ‘C’, ‘B’, ‘L’, ‘G’, ‘X’, ‘N’, ‘H’, ‘F’, ‘C’, ‘D’, ‘Y’]

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)

`python2 GUI.py

1. Driver Details: Does it take care of the options specified earlier(yes/no): yes
2. Execution status (describe in maximum 2 lines)

→ The whole program executes correctly.

1. Declaration: I, Abhishek V Joshi (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 : 2015A7PS0116P Name : Abhishek V Joshi

Date: November 28, 2017

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