Birla Institute of Technology & Science, Pilani
Work - Integrated Learning Programmes Division
Second Semester 2019-2020
Comprehensive Examination
(EC-3 Regular)

Course No.	**: IS ZC444**
Course Title	**: ARTIFICIAL INTELLIGENCE**
Nature of Exam	**: Open Book**
Weightage	**: 50%**
Duration	**: 3 Hours**
Date of Exam	**: Friday, 01-05-2020(AN)**

No. of Pages : 1

No. of Questions : 5

Note:

1. Please follow all the *Instructions to Candidates* given on the cover page of the answer book.

2. All parts of a question should be answered consecutively. Each answer should start from a fresh page.

3. Assumptions made if any, should be stated clearly at the beginning of your answer.

Q.1. (a) Explain on the basis of the theory in the text book and your direct experience of running 8-puzzle programs for different initial states, why the following happens: When we use Iterative Deepening Search (starting from depth limit 2 and maximum depth limit more than d) for an initial state that requires a minimum of d steps to solve, the number of nodes generated in the search are usually less than those generated in search by Breadth First Search. [10]

Q.2. (a) We implement Hill-Climbing on a CNF (Conjunctive Normal Form: an AND of ORs of literals) boolearn expression satisfiability as follows. Starting with a random 0-1 assignment to all variables, we count how many clauses are satisfied by it. If the current assignment does not satisfy all the clauses, then in each step we flip at least 1 and at most d variables randomly chosen. If the new assignment after flipping satisfies more number of clauses than the current one, we make it the current assignment, or else the current assignment is left unchanged. We know in general that Hill-Climbing is incomplete in the sense that it can fail to produce a satisfying assignment even if there is one. But in this boolean satisfiability problem if we guarantee that any assignment tried is not repeated in the random trials, we guarantee that eventually Hill-Climbing will succeed after \(2^n\) trials for an expression in n variables. Argue how this guarantee works. Can we guarantee this with \(d<n\)? [10]

Q.3. (a) Give PEAS description of the Arogya Setu app. This app is supposed to [10]

- Help, via QA/chat, the user to assess one's own health vis-a-vis Covid-19
- Alert the user if another Arogya Setu app user who is supposed to be quarantined is in the vicinity.
- Alert the authorities if such a quarantined person is making movement in breach of the quarantine requirements.
- Alert the authorities if an Arogya Setu user's status vis-a-vis the infection needs to be reassessed and changed with new data.

Q.4. (a) Design a Bayesian Network to give the probability of person A having Covid-19 infection based on the following known factors: [10]

1. If person A spends longer than 10 minutes in close contact (less than 1m distance) with an active patient B of Covid-19 without any one of them wearing a mask, then there is 95% chance that one gets the infection.
2. If in this situation the patient B is wearing a mask the chance is reduced to 60%
3. If in addition person A also is wearing a mask then the chance is reduced to 5%
4. If none of A, B is wearing a mask and they do **not** spend time in close contact with less than 1 m distance but remain in a closed room for a duration of 10 to 30 minutes, then the chance that A gets infected because of B is 30%.
5. In any other situation, the chance that A gets infected because of B is 0%.

Q.5. (a) Express the scenarios described in Q4 using Propositional or Predicate (First Order) Logic. [10]

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