Special Assignment in lieu of Semester End Practical Examination May-June 2020
B.Sc. (Hons.) Computer Science Semester-VI
Paper Code: **32341601**
Paper Name: **Artificial Intelligence**

Answer both questions. +1 mark indicated in brackets against each is for the readability of the solution. 1 Mark is for accurately following submission instructions.

1. Functional Extenstion of the work done earlier [10+1]
Extend the program that you wrote for Assignment – I, adding one additional functional capability. In case you had not done/submitted the assignment earlier, construct afresh with just one most important functionality. (*Brief Statement of Assignment-I Questions are included in the appendix.*). Answer should indicate the extension and its scope clearly.

2. Epidemic Modelling [12+1]
An epidemic can be modeled either from human perspective (HP) – how people get infected, react, and heal/die; or from pathogen's success perspective (PP) – its ability to find more and more hosts before dying out.
Consider a city with population of n (say, for Delhi n = 2,00,00,000) where its people are living:
15% in extreme congestion zone (ECZ)
30% in high congestion zone (HCZ)
35% in moderate congestion zone (MOCZ)
10% in mild congestion zone (MICZ)
7% in moderately spaced zone (MSZ)
2% in safe space zone (SSZ)
0.8% in ideal space zone (ISZ)
0.1% in sparse zone (SPZ)
0.1% in dispersed zone (DZ)

Zones have the following description

Zone	**Average inter-person space (radial) in Dwelling Units (DU)**
ECZ	<=0.5 meters
HCZ	More than 0.5 but < 1 meter
MOCZ	1 to 1.5 meters
MICZ	1.5 to 2 meters
MSZ	2 to 2.5 meters
SSZ	2.5 to 3 meters
ISZ	3 to 5 meters
SPZ	5 to 8 meters
DZ	>8 meters

A pathogen infects by spread of respiratory droplets. Such a droplet stays in air for 30 minutes as aerosol, and is then completely destroyed. Assuming a random distribution of initial carriers (i.e. carrier exists in a set of people with a very small probability, but uniformly – say there is one carrier per r persons (e.g. r = 1 million). The transmission of infection is possible with probability 0.7 if carrier is within 2 meter radius on another person for 5 seconds or more.

Assume daily Mobility of Population (MOP) at three levels:

Static (S) – eveyone stays at home

Dynamic (D) – normal movement for work etc.

Sensitive (SN) – only sick (possibly infected) stay at home/quarantine

The dwelling area is 25% of the total city area. (Rest is roads, parks, offices, and so on...). The average number of persons per DU is linearly inversely proportional to Average inter-person radial distance. When population moves, smaller spaces (say, a bus) get 3 times more persons for relatively shorter duration than larger spaces (say an office) fewer persons for relatively longer duration in the ratio.

(a) Choose a model – HP or PP giving agruments in support of your choice for modeling the epidemic.

(b) With values for n, and r, assumed as per your choice, construct a suitable inference model (program) that can answer questions as following:
   - (i) How much time is needed for x% population to be infected (say x = 1, 5, 10, ...)
   - (ii) Effect on answers to (i) above if MOP is S, D, or SN
   - (iii) Identify the most important change that could be done to the city to handle a future similar epidemic better, illustrating with infection progression data after the change (as in (i) above)

Answer to (a) and (b) should be well reasoned. An implementation of the inference model you construct (say in Prolog) should support your computed data. You are free to restrict the variables, without distorting the fundamental description (for example, MOP could be taken as 2 instead or 3, or fewer no of Zones), similarly, you could introduce more variables as you deem fit, but the design should be rational.

A suggestive hint for Q.2: <You have full freedom to not follow the suggestion>
You could think of a graph where nodes are people, pathogens the tiny travellers on the connecting arcs whose lengths are Zone distances, and reaching other side a function (of distance, probability, and so on...). View this in terms of sets and their properties to visualize a rule-base system, or a belief-world.

Appendix

Brief statement of Assignment - I questions (Only one was to be attempted)

1. Prolog program to evaluate a circuit diagram having combinational and sequential components.
2. Prolog program to change tense, voice of English sentences, built on a limited vocabulary and standard English grammar.
3. Prolog program to rewrite a message, using a small word/clause replacement dictionary, so that transformed message is also meaningful and lucid, but does not directly reveal the true message being sent.

In case there is some query/confusion I shall be available on my email
-from 9:10AM to 12:10 PM on 25-05-2020 and shall respond immediately
-all through the rest of the time, but response may be delayed by 1-2 hours.

-PDS