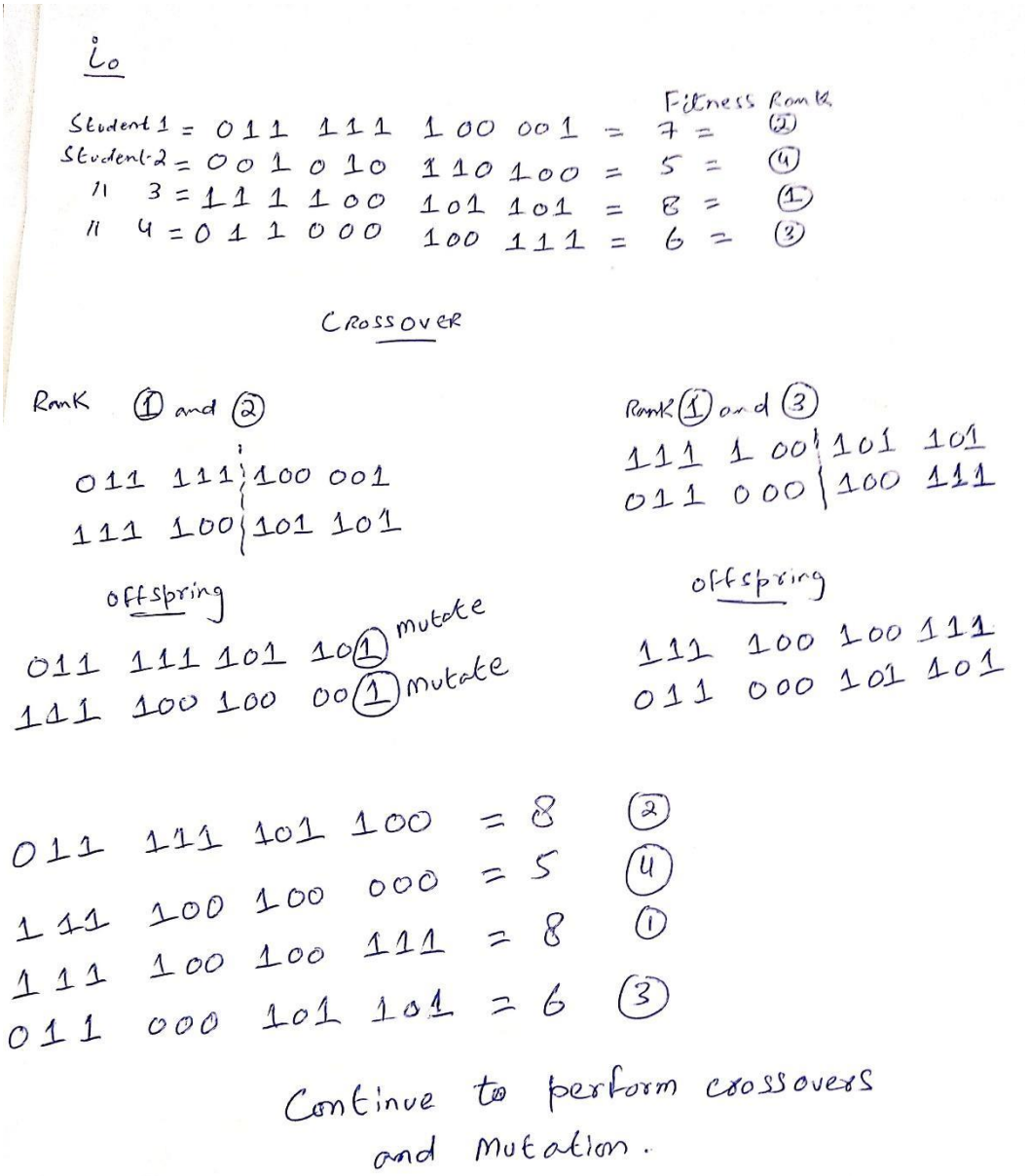
AI MID-2 SPRING 2022 SOLUTION

Result			Attendance			Discipline			Co-Curr.			
0	1	1	1	1	1	1	0	0	0	0	1	Individual 1
0	0	1	0	1	0	1	1	0	1	0	0	Individual 2
1	1	1	1	0	0	1	0	1	1	0	1	Individual 3
0	1	1	0	0	0	1	0	0	1	1	1	Individual 4



The initial population can be given as. I_0 = {011 111 100 001, 001 010 110 100, 111 100 101 101, 011 000 100 111}. By applying mutation and crossover at various places, the aim is to reach to the string '111 111 111 111'; which is a fitness function showing the desired characteristics of the best student. As it is a search for the best student, the objective is to find the candidate with the maximum values in all four parameters. Hence, the individual that has maximum value for Result, Attendance, Discipline, and Co-curriculum activities (i.e. 111 in each aspect) is certainly the best student. As shown above, the genetic operations such as mutation and crossover are performed. Here, the fitness function can alternatively be represented as the sum of the number of 1s in the individual. The ideal number of 1s in the individual representing the best student configuration is 12.

Q2:Your task is to schedule CS department classes that meet Mondays, Wednesdays and Fridays. There are 5 classes that meet on these days and 3 professors who will be teaching these classes. You are constrained by the fact that each professor can only teach one class at a time.
The classes are:

- Class 1 - Intro to Programming: meets from 8:00-9:00am
- Class 2 - Intro to Artificial Intelligence: meets from 8:30-9:30am
- Class 3 – Information Retrieval: meets from 9:00-10:00am
- Class 4 – Data Science: meets from 9:00-10:00am
- Class 5 – Computer Networks: meets from 9:30-10:30am

The professors are:

- Professor A, who is available to teach Classes 3 and 4.
- Professor B, who is available to teach Classes 2, 3, 4, and 5.
- Professor C, who is available to teach Classes 1, 2, 3, 4, 5.

a. Formulate this problem as a CSP problem in which there is one variable per class, stating the domains, and constraints (write unary and binary constraints) **(4 Marks)**
b. Draw the constraint graph associated with your CSP. **(2 Marks)**
c. Show the domains of the variables after running arc-consistency on this initial graph (after having already enforced any unary constraints). **(4 Marks)**
d. Give one solution to this CSP. **(2 Marks)**

Q3: Solution:

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  CRACK
 +HACK
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  ERROR
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4 2 6 4 1

+ 9 6 4 1

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5 2 2 8 2

Q:2 CSP

Variables

C_1 = {A, B, C}, As ~~Prof~~ Prof C can only teach class 1

Variables Domain

C_1 = {C}

C_2 = {B, C}, Prof B & C can teach C_2

C_3 = {A, B, C}, All Prof can teach C_3

C_4 = {A, B, C}

C_5 = {B, C} = only B & C can teach C_5

Binary constraints

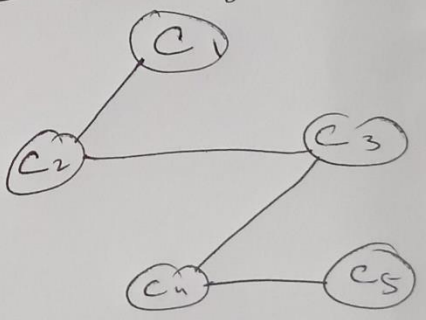
$C_1 \neq C_2$

$C_2 \neq C_3$

$C_3 \neq C_4$

$C_4 \neq C_5$

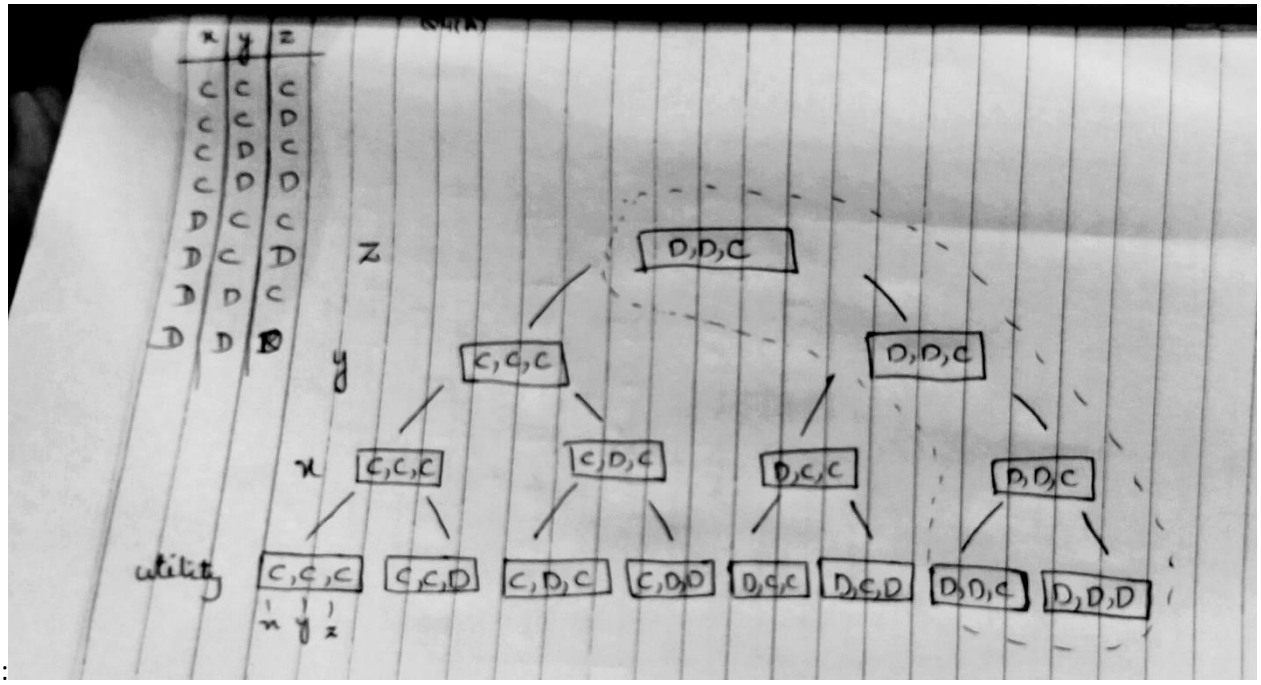
(b) constraint graph



(c) Arc consistency

Variable		Domain
C_1	=	{C}
C_2	=	{B} → Remove C from C_2 Domain
C_3	=	{A, C} → Remove B from C_3 Domain
C_4	=	{A, B, C} ← consistent Arc
C_5	=	{A, B, C} ← consistent Arc

Q4:



Qno 05 Solution:

P(positive|covid19) = 0.99

P(covid19) = 0.6

P(positive) = 0.6 * 0.99 + 0.4 *0.01 = 0.598

$$P_{Covid19,positive} = P(positive|covid19)P(covid19)P(positive)$$

$$P_{Covid19,positive} = 0.99\ \ 0.60.598 = 0.993$$