Discrete Optimization for Course Selection

Linda Lee, a second year BCG student, would like to determine her course schedule for her two semesters. Linda has created a list of twenty potential courses that most interest her, shown in table below. Linda has ranked her interest in each of these courses as a number between 3 and 5. The course data is extracted from http://web.nbs.ntu.edu.sg/undergrad/common/contents/courselist.asp

Course Number	Course Code	Course Title	Semester offered	Prerequisites	Interest Level
1	AB0403	Decision Making with Programming & Analytics	1,2		5
2	BA2201	Actuarial Economics	2		5
3	BU5201	Business Finance	1,2		4
4	BE1401	Business Operations & Process	1,2		4
5	BT2403	Service Operations Management	1		4
6	BC3406	Business Analytics Consulting	2	10, 13	3
7	AB0602	Communication Management Strategies	1,2		3
8	AB5103	Audit Analytics	1,2	1	5
9	BF3224	Equity Investing with Big Data	2	13	4
10	BC2406	Analytics I: Visual & Predictive Techniques	1	1	4
11	BC2407	Analytics II: Visual & Predictive Techniques	2	1,10	3
12	BM2507	Marketing Analytics	1,2	13	3
13	AB1202	Statistics & Analysis	1,2		4
14	BC2408	Supply Chain Analytics	2	4	4
15	BC2410	Prescriptive Analytics: From Data to Decision	2	1	5
16	BU5644	Smarter Brain? The Science of Decision Making Management	2		5
17	AB0502	Managing Sustainability	1		5
18	BM2501	Market Behaviour	1,2	20	3
19	BM2504	Integrated Marketing Communications	2	20	3
20	AB1501	Marketing	1,2		4

Linda is allowed to take at most **five** courses in each semester. In determining her course schedule, she needs to consider the following:

- Linda can only take a course if she has completed or is currently taking all courses that are prerequisites for the course.
- In Semester 1, Linda must take at least three of the following five courses: course 1, course 3, course 4, course 5, and course 20.

- If Linda takes course 12, she will not be allowed to take course 18, because these two courses cover fairly similar materials.
- Linda would like to take at least two courses in Marketing (course 12, 18, and 20) and at least two courses in Analytics (course 1, 8, 10, 11, 14, 15).

Help Linda to maximize her total interest level.

(Hint:

Let $x_{ij} = \begin{cases} 1 & \text{if course } j \text{ is selected at semester } i \\ 0 & \text{otherwise} \end{cases}$ where $i = 1,2 \; and \; j = 1,2, \dots ,20$

Let $a_{ij} = \begin{cases} 1 & \text{if course } j \text{ is offered at semester } i \\ 0 & \text{otherwise} \end{cases}$ where $i = 1,2 \; and \; j = 1,2, \dots ,20$

For example, $a_{1,6} = 0, a_{1,17} = 1$.
Let I_j be the interest level of course $j, for \; j = 1,2, \dots ,20$.)