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Homework 9 (15 pts)

OK, let’s get (close to) real for a week. Suppose that you come into Metro with an AA degree and some work towards a liberal arts major of some sort, which you abandoned (in other words, a typical Metro student, in some ways). So you got a little Math (College Algebra) but no higher math or computing courses, but your old coursework took care of all your GELS & RIGR requirements, so to get a CS degree you need to take 17 courses:

* Math 120, 210, 215;
* ICS 140, 141, 232, 240, 311, 340, 365, 372, 440, 460, 462, 499
* Two ICS electives. Electives are noted as “Elect nnn”. By the way, “Elect C” is a general term for cybersecurity electives with a prerequisite of ICS 382 or ICS 460. I lumped them all together.

You want to complete this is 6 semesters, starting Spring of 2020 and ending Fall of 2021. There are three constraints (one multi-part):

1. You want to take no more than three courses in any semester (meaning that you will end up taking three courses in five different semesters, and two courses in the other semester).
2. You can only take one course per day. The course schedule is listed on the next page.
3. You will follow the prerequisite chain. The prerequisites are listed on the next page.

By the way:

* These are by and large the real courses at the real times they were/are/will be offered.
* These are essentially the real prerequisites.
* Starting in the fall 2021, Cybersecurity courses ae named “CYBR” rather than “ICS”, and you may only take one of them as an elective. (They have been eating up our real Computer Science electives.)

Schedule (w/prerequisites) (& means AND)

Days: A: Asynch,[[1]](#footnote-0) M: Monday, T: Tuesday, W: Wednesday, H: Thursday, F: Friday, S: Saturday

1. [5 pts] Suppose that you had working compute programs that did the following:
   1. A program that implements the Generalized Arc Consistency (GAC) algorithm

Answer: following GAC algorithm we need set variables, Domains, and Constraints.

Set of Variables like: c1, c2, c3…that represent the courses.

Subdomain of semester like: Ds={1,2,3,4,5,6},

subdomain of Number of each course like: Dn = {ICS141, ICS140…},

and subdomain of days like: Dd = {A, M, T…S}.

all these domains are subdomain of Domain of each Course,

like: Dc1 = {{1,…6}, {ICS140…}, {A, M, T…}}… represent each semesters of courses.

Set Constraints like: size of c1 <= 3 courses, one course per day like c1 = {M}, and follow the prerequisite chain like: Math120 < Math210…

Then follow the row of constraints figure out courses, semester, and day for solution.

* 1. A program that does local search using iterative best improvement, with appropriate randomness (random walks an random restarts)

Answer: First taking appropriate randomness like random of semester, day for each number of course. And see the value of conflicts we have, than improving by using a two-stage choice algorithm and adjust the parameter of each domain to decrease the number of conflicts and evaluation to be 0. Then take random restarts again and so on. finally we should get the result if there have the solution, or give up.

* 1. A program that uses genetic algorithms to solve CSPs.

Answer: Start with evaluate the two random parents of variables, P1 and P2.

Do a 1-point crossover in the middle to get 2 children C1 and C2.

Evaluate the two children C1 and C2 to choose the best child, Ca.

Then, again evaluate the new two random parents of variables, P3 and P4.

Again do a 1-point crossover in the middle to get 2 children C3 and C4, and evaluate the two children C3 and C4 to choose the best child Cb.

So that we can cross over the best children Ca and Cb, then evaluate both of them and pick the best grandchild.

Repeat again, and so on.

* 1. A program that solves CSPs via variable elimination.

Answer: Take a set of variables Vs within a relation in constraints Cs. Like consider A, B, C so to get the relation on A and C induced by B, project this join onto A and C, so we eliminated B. We repeat with this process all variable in the set for finding all solution to a CSPs.

1. [5 pts] Solve the problem, however you want to. Write your solution in the table below. With 17 courses and 6 semesters, one cell will be left blank.

Note that “Number” includes identifier, so “ICS 140” is a number. Or you could just put numbers, since the numbers of the Math and ICS courses are disjoint.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Courses 🡪** | **Course 1** | | **Course 2** | | **Course 3** | |
| **Semesters 🡻** | **Number** | **Day** | **Number** | **Day** | **Number** | **Day** |
| **Spring 2020** | Math 120 | M | Math 215 | T | ICS 140 | W |
| **Summer 2020** | Math 210 | M | ICS 141 | T |  |  |
| **Fall 2020** | ICS 240 | M | ICS 311 | T | ICS 232 | W |
| **Spring 2021** | CYBR 332 | M | ICS340 | T | ICS 365 | W |
| **Summer 2021** | ICS 440 | M | ICS 372 | T | CYBR 362 | W |
| **Fall 2021** | ICS 499 | M | ICS 462 | T | ICS 460 | W |

1. [5 pts]  *Assuming you have done question 2, this is the easiest 5 points you’ll have all semester.* How did you arrive at your solution to question #2? Did anything we learned in thus far in the course help you arrive at this solution? Restrict your answer to the rest of this page.

Answer: I think I use the simple way to do by following the graph on Homework 8 with Generalized Arc Consistency algorithm that have the constrains display on the graph and also consider the new constrains in this homework too. Looking one by one of each course or variable begin from the small one like Math 120, Math 210 compare step by step to the next larger one until finish.

1. You can take an asynchronous course along with anything, including another asynchronous course. [↑](#footnote-ref-0)