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-1) 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
   2. A program that does local search using iterative bet improvement, with appropriate randomness (random walks an random restarts)
   3. A program that uses genetic algorithms to solve CSPs.
   4. A program that solves CSPs via variable elimination.

With such programs, how would you attack this problem? Restrict your answer to the rest of this page.

*Note that there are many solutions to this problem. I give one.*

***Solution:***

I would start out running the GAC algorithm to prune the domains of the courses. There’s no downside to doing this, and it makes any local search or genetic algorithms that much easier.

Then I’d do a local search or genetic algorithm to find a schedule that worked. To simplify things, I would probably add in a “dummy” course with no prerequisites that is available asynchronously, then find a schedule with three courses per semester.

Based on my past programming experience, I would probably do a local search rather than a genetic algorithm, because I’ve had better luck with it.

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.

***Solution:***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Courses 🡪** | **Course 1** | | **Course 2** | | **Course 3** | |
| **Semesters 🡻** | **Number** | **Day** | **Number** | **Day** | **Number** | **Day** |
| **Spring 2020** | Math 120 | W | Math 215 | M | ICS 140 | T |
| **Summer 2020** | Math 210 | T | ICS 141 | H |  |  |
| **Fall 2020** | ICS 232 | T | ICS 240 | F | ICS 311 | M |
| **Spring 2021** | ICS 340 | M | ICS 365 | T | ICS 372 | H |
| **Summer 2021** | ICS 440 | M | ICS 460 | H | ICS 462 | A |
| **Fall 2021** | ICS 499 | M | ICS 382 | A | ICS 411 | S |

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.

*There isn’t really a right answer for this. Anything that works is good.*

***Solution:***

I pruned the domains by hand, and then followed the advice I usually give to students: Get the math out of the way first, then the required courses, and fit in electives as late as possible wherever you can.

Once I pruned the domains, I chose to take the only three courses I could take the first semester (Spring 2020). This forced Summer 2020 to have only two courses, which were forced. After that, I took the three lowest numbered required courses every semester, and finished up with the Capstone and two electives.

Appendix: Pruned domains:

Greyed domains are pruned. ***Bold underlined italics*** indicate day taken.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Course** | **Prereqs** | **Sp 20** | **Su 20** | **Fa 20** | **Sp 21** | **Su 21** | **Fa 21** |
| Math 120 | - | ***W***H | W | TF | WH | W | TF |
| Math 210 | Math 120 | TH | ***T*** | MT | TH | T | MTW |
| Math 215 | - | ***M***TWH | MH | MTWH | MTW | MH | MTWH |
| ICS 140 | - | M***T***WS | T | MTWH | MTW | TH | MWH |
| ICS 141 | ICS 140 | MWHF | MW***H*** | MTW | MTHF | TW | MTW |
| ICS 232 | ICS 141 &  Math 215 | MW | M | ***T*** | MW | H | T |
| ICS 240 | ICS 141 &  Math 215 | HS | TW | M***F*** | HS | TH | M |
| ICS 311 | ICS 141 &  Math 215 | MWH | MW | ***M***WH | MTH | MW | MTH |
| ICS 340 | ICS 240 | MH | W | MT | ***M***WH | H | MH |
| ICS 365 | ICS 240 | TW | M | MW | ***T***W | M | TW |
| ICS 372 | ICS 240 | TH | A | H | T***H*** | T | M |
| ICS 440 | ICS 232 & 340  Math 210 | MH | H | H | MH | ***M*** | M |
| ICS 460 | ICS 232 & 240  Math 210 | T | T | TW | TM | ***H*** | TH |
| ICS 462 | ICS 232 & 240  Math 210 | MW | - | MH | MW | ***A*** | AH |
| ICS 499 | ICS 232 & 372  Math 210 | WH | WS | MTW | WH | MW | ***M***TH |
| Elect 352 | ICS 240 | - | - | H |  | - | H |
| Elect 382 | ICS 141 &  Math 215 | AT | A | A | A | AH | ***A*** |
| Elect 411 | ICS 232 & 311  Math 210 | - | - | S | - | - | S |
| Elect 412 | ICS 232 & 240  Math 210 | H | - | - | M | - | - |
| Elect 425 | ICS 232 & 240  Math 210 | - | - | W | - | - | ***W*** |
| Elect 471 | ICS 232 & 240  Math 210 | - | - | - | H | - | - |
| Elect C | ICS 382 ***or***  ICS 460 | MTW | A | T | MTW | H | MWH |

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