Question 2: Constraint Satisfaction Problem - Course Scheduler

Variables (courses)

$\{ c_i \in C \mid c_i \text{ is of the form } [course,\ term,\ (prerequisites)] \}$

For example:

$\{ [Math\ 120,\ Term1,\ ()],\ [CSC110,\ Term2,\ (Math\ 120)],\ [Math\ 100,\ Term3\ (Math120)],\ ... \}$

Domain (term-slots)

$\{ d_i \in D \mid d_i \text{ is a quad tuple of the form } (term, year, weekday, timeslot) \}$

For example: $\{ (1, 18, 1, 1),\ (1, 18, 1, 2),\ ... , (3, 22, 5, 8) \}$ =

$\{ (Term1, 2018, Monday, 8\ a.m.),\ (Term1, 2018,\ Monday, 9\ a.m.),\ ... , (Term3, 2022, Friday, 3\ p.m.) \}$

Constraints

Prerequisite courses

For all courses offered with a prerequisite course, it must be the case that the prerequisite course is taken in a term prior to the course in question.

$\{ \forall\ c_i\, c_k \in C \mid c_i \text{ is a course and } c_k \text{ is a prerequisite of } c_i \text{ then } c_k \text{ exists in the assignment prior to } c_i \}$

Courses offered in certain terms only

For all courses offered, it must be the case that the “term” portions of the term-slot quad are equivalent to the “term” portion of the course variable triple.

$\{ \forall\ c_i \in C,\ d_i \in D,\ t_c \in c_i,\ t_d \in d_i \mid t_c = t_d \}$

Not more than 4 courses per term

For all courses in any given term and year, the sum of course term-slot assignments where the terms and years are equivalent cannot exceed 4.

$\{ a_i \in A,\ c_i \in C,\ d_i \in D \mid a_i \text{ is any satisfying combination of assignments of course termslot pairs } (c_i, d_i) \}$

$\{ \forall\ p_i\, p_j\, p_k\, p_l \in A \mid \text{The terms and years of } p_i = p_J = p_k = p_l \text{ are the only four pairs in that term and year} \}$

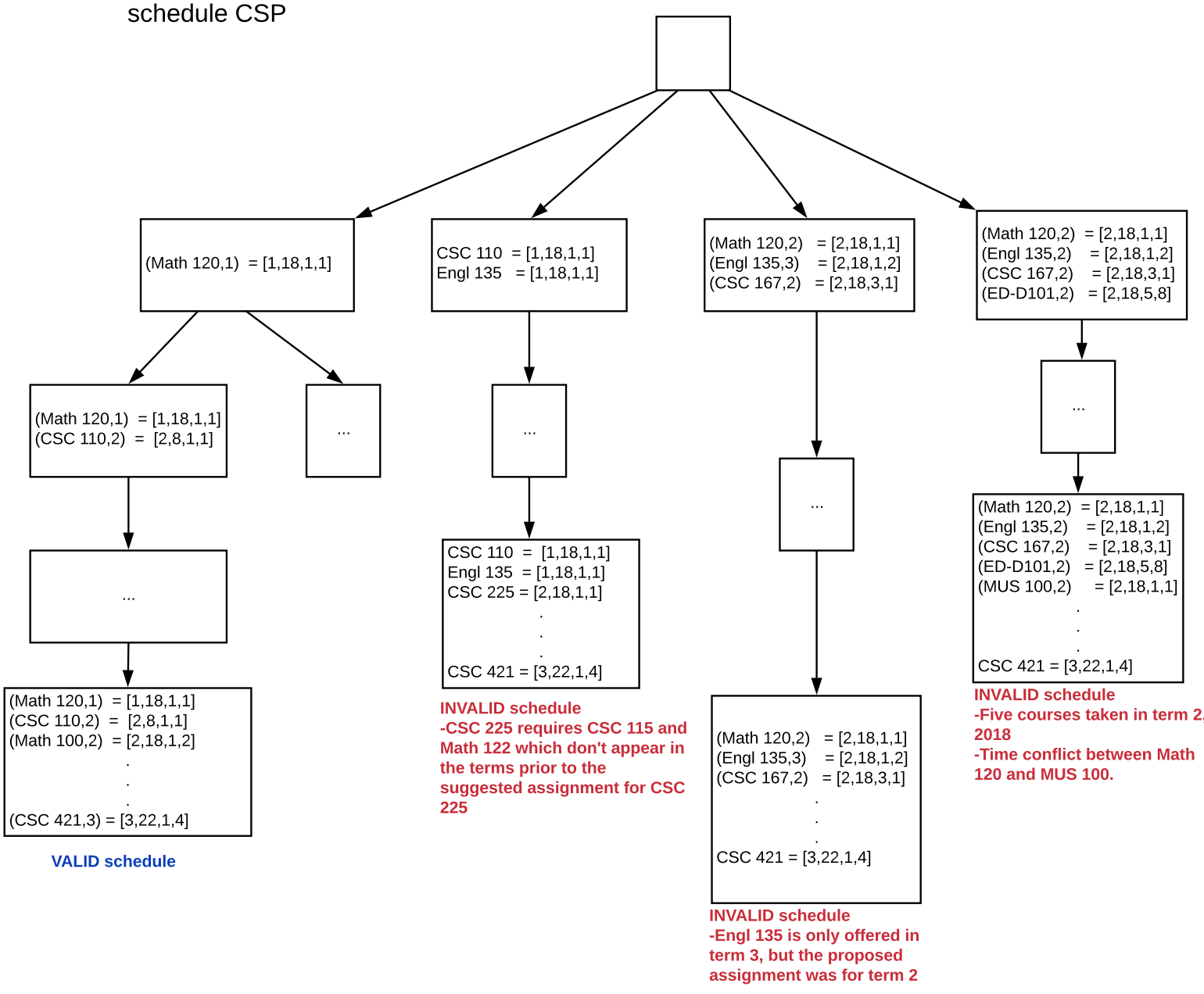
Time conflicts should be avoided

For any four courses where the term, year, and weekday are equivalent, it cannot be the case that the time-slot is equivalent.

$\{ \forall\ p_i\, p_j\, p_k\, p_l \in A \mid term,\ year,\ weekday \text{ of } p_i = p_J = p_k = p_l,\ \text{then timeslots } p_i \neq p_J \neq p_k \neq p_l \}$

(See next page for examples of satisfying assignments and constraint violations)

Question 2
Example search tree for class schedule CSP



VALID schedule

INVALID schedule
-CSC 225 requires CSC 115 and Math 122 which don't appear in the terms prior to the suggested assignment for CSC 225

INVALID schedule
-Engl 135 is only offered in term 3, but the proposed assignment was for term 2

INVALID schedule
-Five courses taken in term 2, 2018
-Time conflict between Math 120 and MUS 100.