DB Schemas for HUMANITIES_REQUIREMENT

HUMANITIES_REQUIREMENT

- All students must take CAL 103 and CAL 105 as freshmen, plus at least six humanities electives. No AP credit is given for CAL 103 or CAL 105.
- At least one of the electives must be at the 100 or 200 level.
- At least one of the electives must be at the 300 level or higher.
- Electives must be taken in at least two of the four humanities divisions: Literature, Philosophy, History, and Social Science.
- One of the electives must be HSS 371 (Computers and Society) or HPL 455 (Ethical Issues in Science and Technology).
- Only certain art and music courses may count toward the humanities elective requirement. They are:
  - HAR 180 History of Art: Prehistory to the Modern Era
  - HAR 181 History of Technology in the Arts
  - HAR 280 Modern Art History and Theory
  - HAR 281 History of Photography
  - HAR 380 Media Culture and Theory
  - HAR 389 History of Middle Eastern Art
  - HAR 485 Contemporary Art
  - HMU 101 Music History I
  - HMU 102 Music History II
  - HMU 192 Music Appreciation I
  - HMU 193 Music Appreciation II
  - HMU 195 History of Electronic and Experimental Music
  - HMU 350 Music of the Eastern Mediterranean

A Slightly Reordered Version of HUMANITIES_REQUIREMENT

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A Slightly clearer(?) Version of HUMANITIES_REQUIREMENT

- **EARLY_CAL_REQUIREMENT**
  - All students must take CAL 103 and CAL

    = 2 courses from the set {(CAL, 103), (CAL, 105)}
- **6_HUM_ELECTIVES_REQUIREMENT**
  - All students must take six humanities electives
    - **SOCIETY_&_ETHICS_ELECTIVE REQUIREMENT**

      One of the six humanities electives must be HSS 371 (Computers and Society)

      or HPL 455 (Ethical Issues in Science and Technology)

      = 1 course from the set {(HSS, 371), (HPL, 455)}
- At least one of the six electives must be at the 100 or 200 level.
- At least one of the six electives must be at the 300 level or higher.
- Electives must be taken in at least two of the four humanities divisions: Literature, Philosophy, History, and Social Science.
- Only certain art and music courses may count toward the humanities elective requirement. They are:
  - HAR 180 History of Art: Prehistory to the Modern Era
  - HAR 181 History of Technology in the Arts
  - HAR 280 Modern Art History and Theory
  - HAR 281 History of Photography
  - HAR 380 Media Culture and Theory
  - …

6_HUM_ELECTIVES_REQUIREMENT

means that including SOCIETY_&_ETHICS_ELECTIVE REQUIREMENT

The 6 courses must be from:

The set of all courses with one of the following prefixes: HHS, HLI, HPL, and HSS

UNION

{(HAR, 180), (HAR, 181), (HAR, 280),
(HAR, 281), (HAR, 380), (HAR, 389),
(HAR, 485), (HMU, 101), (HMU, 102),
(HMU, 192), (HMU, 193), (HMU, 195),
(HMU, 350)}

We can specify this requirement by constructing a set_of_courses that includes every course with a prefix of HHS, HLI, HPL, or HSS, and also includes an instance for each of the listed HAR and HMU courses. If we name this set HUM_ELECTIVE_COURSES, then 6_HUM_ELECTIVES_REQUIREMENT can be defined as “6 from HUM_ELECTIVE_COURSES.”

We’ll see, later, how we can do this in a much simpler way

Constraints

- The remaining “requirements,” that is, those listed below, are actually constraints on the courses that are taken to satisfy the electives requirement, and are not additional requirements
  - At least one of the electives must be at the 100 or 200 level.
  - At least one of the electives must be at the 300 level or higher.
  - Electives must be taken in at least two of the four humanities divisions: Literature, Philosophy, History, and Social Science.
- What this means is that the courses chosen to satisfy the **6_HUM_ELECTIVES_REQUIREMENT** must satisfy the three constraints listed above.

In Other Words

The set of courses taken to satisfy

6_HUM_ELECTIVES_REQUIREMENT

(including SOCIETY_&_ETHICS_ELECTIVE_REQUIREMENT)

must satisfy:

- 1. 100_OR_200_LEVEL_CONSTRAINT:

  At least one of the courses taken to satisfy the requirement must be at the 100 or 200 level.
- 2. 300_OR_HIGHER_LEVEL_CONSTRAINT:

  At least one of the courses taken to satisfy the requirement must be at the 300 level or higher.
- 3. And HHS_or_HLT_or_HPL_or_HSS_CONSTRAINT:
  - At least one of the courses taken to satisfy the requirement must have a prefix from the set {HHS, HLI, HPL, or HSS}
  - At least one (other) of the courses taken to satisfy the requirement must have a different prefix from the set {HHS, HLI, HPL, or HSS}

Here's a start to the way we'll handle these constraints

set_of_constraint_courses

set_of_constraint_courses (<u>name_of_set</u>,
course_prefix,
min_course_number, max_course_number)

- Each row of an instance of set_of_constraint_courses specifies a set of courses, by specifying either just the prefix of courses in the set, or just the minimum and maximum numbers of the courses in the set, or both the prefix of and the minimum and maximum numbers of courses in the set.
- name_of_set is the name of the set of courses
- course_prefix if it is non-null, specifies the prefix of all courses in the set.
- min_course_number , if it is non-null, specifies the minimum course number of courses in the set
- max_course_number if it is non-null, specifies the maximum course number of courses in the set.

Here are the first two instances of set_of_constraint_courses

set_of_constraint_courses (<u>name_of_set</u>, course_prefix, min_course_number, max_course_number)

100_OR_200_LEVEL	null	100	299
300_OR_HIGHER_LEVEL	null	300	899

The first row defines the set of all courses with numbers between 100 and 299, and with any prefix whatsoever.

The second row defines the set of all courses with numbers between 300, and 899, the highest number assigned to any course, and with any prefix.

- Here are the additional instances of set_of_courses that we'll need to specify HHS_or_HLT_or_HPL_or_HSS_CONSTRAINT:
  - At least one of the courses taken to satisfy the requirement must have a prefix from the set {HHS, HLI, HPL, or HSS}
  - At least one (other) of the courses taken to satisfy the requirement must have a different prefix from the set {HHS, HLI, HPL, or HHS}

HHS_COURSES	HHS	null	null
HLT_COURSES	HLT	null	null
HPL_COURSES	HPL	null	null
HSS_COURSES	HLT	null	null

constraint_root

constraint_root (<u>constraint_root_node_id</u>,
name_of_constraint,
name_of_requirement,)

- Each row of an instance of constraint_root is the root of a tree that defines a constraint
- name_of_constraint is the name of a constraint that is to be imposed on a requirement.
- name_of_requirement is the name of the requirement on which the constraint is to be imposed.

constraint_node

constraint_node (degree_constraint_node_id,
name_of_set_of_courses,
number_from_set_of courses,
Boolean_operator,
constraint_left_subtree_id,
constraint_right_subtree_id)

- Each row of constraint_node describes a node in the binary tree that defines a constraint.
- name_of_set_of_courses together with number_from_set_of courses, both of which are non-null only when the node is a leaf node, specifies a detail of the constraint.
- Boolean_operator, constraint_left_subtree_id, and constraint_right_subtree_id, which are non-null only if the node is not a leaf node, further describe the structure of the binary tree.

HHS_or_HLT_or_HPL_or_HSS_CONSTRAINT

- At least one of the courses taken to satisfy the three requirements must have a prefix from the set {HHS, HLI, HPL, or HSS}

- At least one (other) of the courses taken to satisfy the three requirements must have a different prefix from the set {HHS, HLI, HPL, or HSS}

This Means

1 course from HHS
and
1 course from HLI

or

1 course from HHS
and
1 course from HPL

or

1 course from HHS
and
1 course from HSS

or

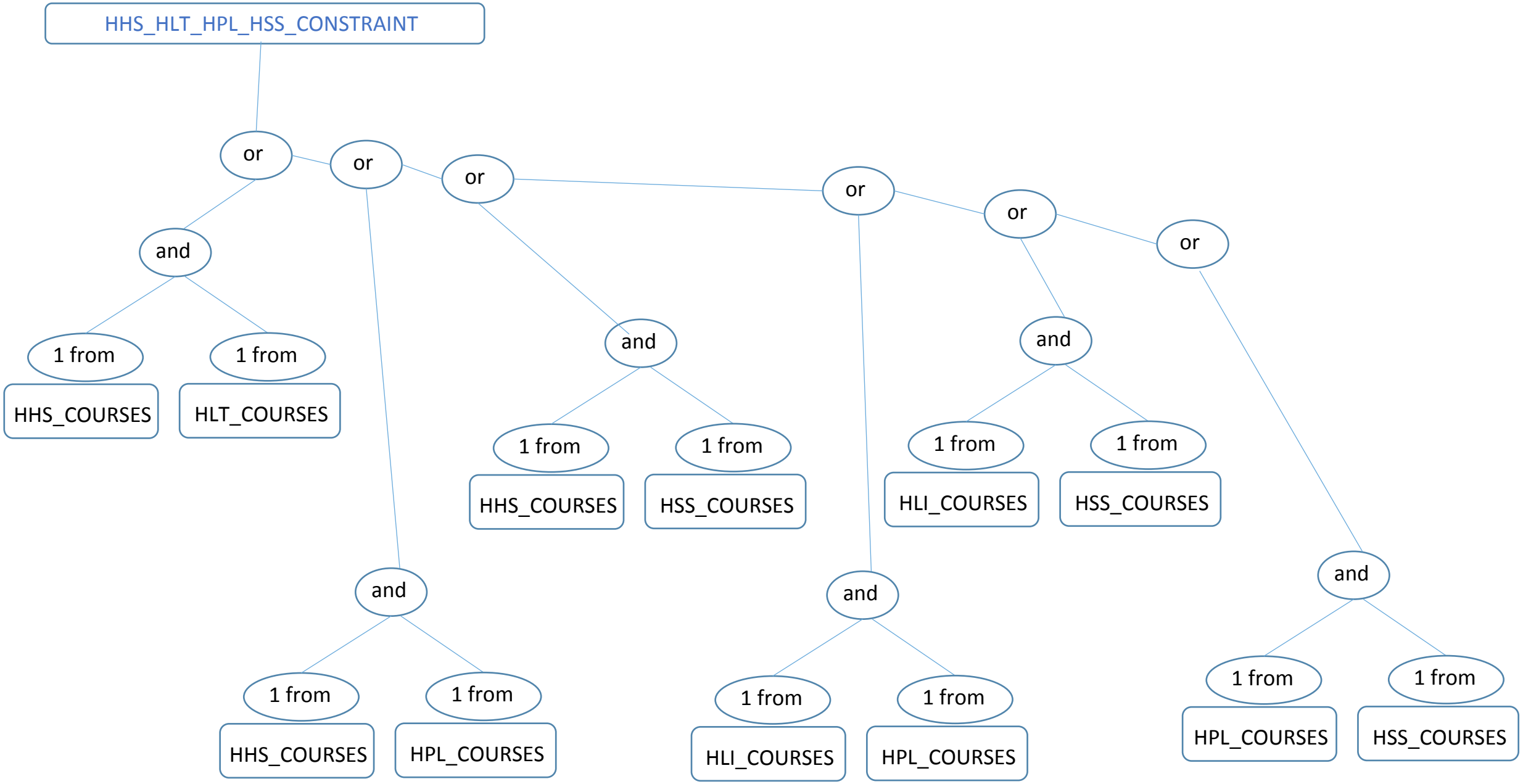
1 course from HLI
and
1 course from HPL

or

1 course from HLI
and
1 course from HSS

or

1 course from HPL
and
1 course from HSS


HHS_HLT_HPL_HSS_CONSTRAINT
or
or
or
or
or
or
and
1 from
HHS_COURSES
1 from
HLT_COURSES
and
1 from
HHS_COURSES
1 from
HSS_COURSES
and
1 from
HHS_COURSES
1 from
HPL_COURSES
and
1 from
HLI_COURSES
1 from
HPL_COURSES
and
1 from
HLI_COURSES
1 from
HSS_COURSES
and
1 from
HPL_COURSES
1 from
HSS_COURSES

The Rest of the Detail is Pretty Easy

- So we'll let you fill in details

- BUT
  - Constructing the table for **6_HUM_ELECTIVES_REQUIREMENT** would take quite a bit of work
  - Constructing the tables for some other requirements, for example FREE_ELECTIVES_REQUIREMENT would also take quite a bit of work.
- SO
- Have we seen something in this lecture that would make all of these much easier?

- Design database schemas that will enable us to model
  - SCIENCE_MATH_ELECTIVE_REQUIREMENT
  - FREE_ELECTIVE_REQUIREMENT
  - PHYS_ED_REQUIREMENT
  - CS_STARTING_COURSE_REQUIREMENT
  - TECH_ELECTIVES REQUIREMENT

  as requirements. (Document the tables and attributes, and be sure to include fkrs.)
- Construct instances of all the required schemas necessary to represent all the above mentioned requirements as we've been discussing in class.

The following schema, which, we developed in order to be able to specify HUMANITIES_REQUIREMENT, suggests a way that we might handle the last five requirements:

set_of_constraint_courses (<u>name_of_set</u>,
course_prefix,
min_course_number, max_course_number)

- Each row of an instance of set_of_constraint_courses specifies a set of courses, by specifying either just the prefix of courses in the set, or just the minimum and maximum numbers of the courses in the set, or both the prefix of and the minimum and maximum numbers of courses in the set.
- name_of_set is the name of the set of courses
- course_prefix if it is non-null, specifies the prefix of all courses in the set.
- min_course_number , if it is non-null, specifies the minimum course number of courses in the set
- max_course_number if it is non-null, specifies the maximum course number of courses in the set.

So Let's Consider SCIENCE_MATH_ELECTIVE_REQUIREMENT

2 from: any 3-credit physics (PEP), chemistry (CH), biology (BIO), or mathematics (MA) course, except:

- Any course that is required for your study plan.
- Any course that is equivalent to another course counted towards the degree. For example, MA 117, MA 118, MA 119, MA 134, and MA 502 may not be counted.

But

- As a general principal, the software we're developing will not allow any course to be used to satisfy more than one requirement, so the requirement can be stated as:

2 from: any 3-credit physics (PEP), chemistry (CH), biology (BIO), or mathematics (MA) course, except:

- ~~Any course that is required for your study plan.~~
- Any course that is equivalent to another course counted towards the degree. For example, MA 117, MA 118, MA 119, MA 134, and MA 502 may not be counted.

So

- We have to come up with a schema whose instance somehow includes
  - the set of all courses with the prefix PEP
  - the set of all courses with the prefix CH
  - the set of all courses with the prefix BIO
  - the set of all courses with the prefix MA
- except for the members of the set {(MA, 117), (MA, 118), (MA, 119), (MA, 134), and (MA, 502)}
- We can easily figure out a way of subtracting one set of courses from another set, but…

If

- we use the schema

  course (<u>course_prefix, course_number</u>,
  course_name, credits,
  prereqs_root_id, coreqs_root_id)

  to create the instances of the sets of all courses with the prefixes PEP, CH, BIO, and MA, then a great deal of work will have to be done to populate the instances, and the administrative user might not be willing to use the software.

But

- the schema

  set_of_constraint_courses (<u>name_of_set</u>,

  course_prefix,

  min_course_number, max_course_number)

Suggests a better approach

Namely

- If we substitute

  set_of_courses (<u>name_of_set</u>,

  course_prefix,

  min_course_number, max_course_number,

  course_name,

  credits,

  prereqs_root_id,

  coreqs_root_id)

for the original **set_of_courses** schema…

Then

- It can be used to specify a single course – e.g., a specific required course.
- It can be used to specify the set of all courses with a given prefix – e.g., PEP, CH, BIO, or MA.
- It can be used to specify the set of all courses with an unspecified prefix, and with numbers within a given range, that is, with any prefix -- e.g., for **FREE_ELECTIVE_REQUIREMENT** or **6_HUM_ELECTIVES_REQUIREMENT** constraints.

To see how, see the next few slides

A Single Course

name of set	course prefix	min course number	max course number	course name	credits	prereqs root id	corereqs root id
null	CS	115	null	Introduction to Computer Science	3	null	null

The Set of All 3-Credit Courses With a Given Prefix

name of set	course prefix	min course number	max course number	course name	credits	prereqs root id	corereqs root id
PEP_ COURSES	PEP	null	null	null	3	null	null
CH_ COURSES	CH	null	null	null	3	null	null
BIO_ COURSES	BIO	null	null	null	3	null	null
MA_ COURSES	MA	null	null	null	3	null	null

The Set of All Courses Whose Numbers Are Within a Given Range

name of set	course prefix	min course number	max course number	course name	credits	prereqs root id	corereqs root id
100_OR_200_LEVEL	null	100	299	null	3	null	null

CS_STARTING_COURSE_REQUIREMENT and TECH_ELECTIVES REQUIREMENT

- Can’t be specified separately from one another
- But they can be specified together, given that the requirements are

  - ((CS115 and CS284 and CS385) and 2 TECH_ELECTIVES)

  or

  - ((CS110 and CS115 and CS284 and CS385) and 1 TECH_ELECTIVES)

  or

  - ((CS181 and CS182) and 2 TECH_ELECTIVES)

  or

  - ((CS000 and CS284 and CS385) and 2 TECH_ELECTIVES)

  or

  - ((CS000 and CS115 and CS284 and CS385) and 1 TECH_ELECTIVES)

  or

  - ((CS000 and CS181 and CS182) and 2 TECH_ELECTIVES)