Northeastern University
CS 5200 – Database Management System
Fall 2019, Quanwei Hao

Assignment 1

1 List nouns that are candidate classes or attributes

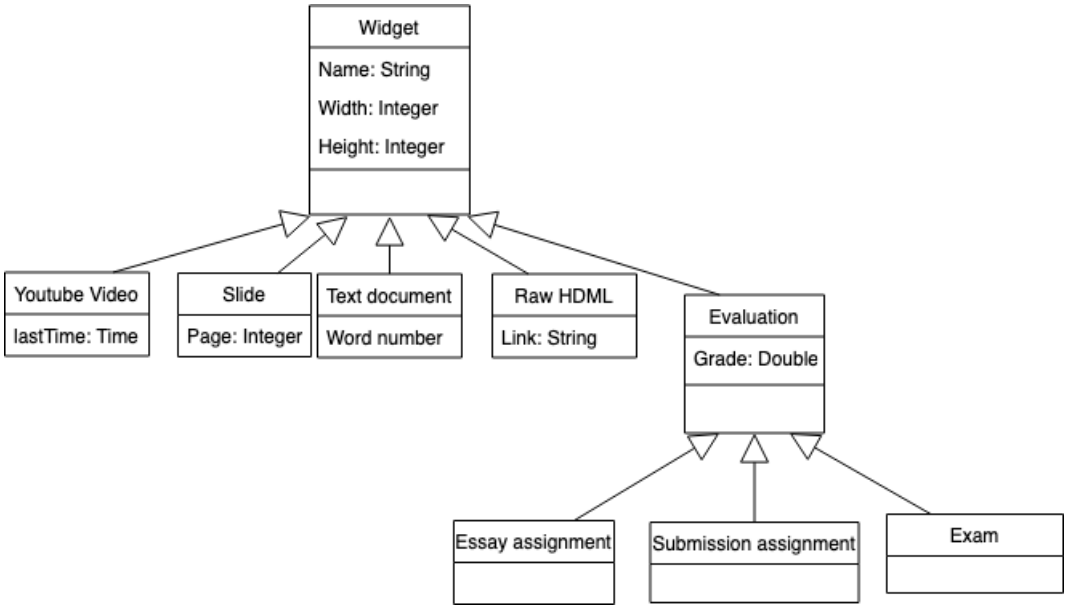
Nouns that are candidate classes	Learning Management System (LMS), Tools, Faculty, Student, Courses, Learning Modules, Lessons, Calendar Schedule, Content Widgets, Evaluation Widgets, Exam, Questions, Assignments, Sections, Semester, Track, Profile, Enrollment, Final Grades, Letter grade, Student feedback, Point, Rubric, Teaching Assistant
Nouns that are candidate attributes	Seat Capacity, Username, Password, First Name, Last Name, Emails, Phones, Addresses, Benefits, Tenure Status, Parking, Bank Account Info, Financial Aid Info, Work-study, Office hours, Scholarship

2 List verbs as candidate relations between classes

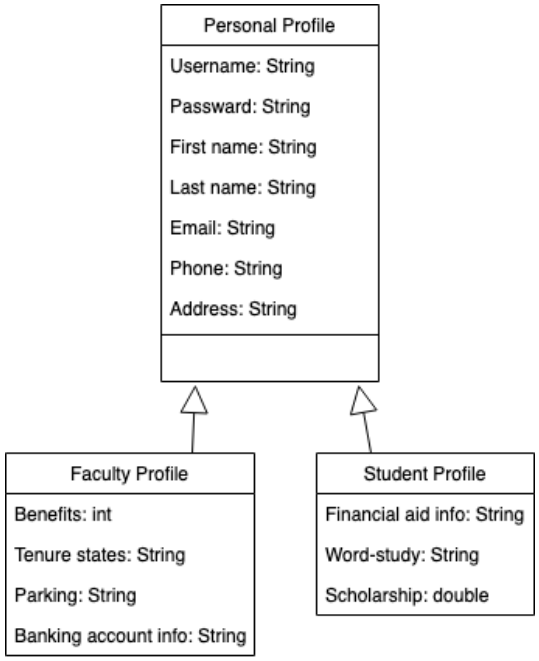
	Verbs	
Learning Management System (LMS)	provides	tools
Faculty	author	courses
Modules and lessons	be rearranged	by calendar schedule
LMS	provides	widgets
Exams	evaluate	progress
Sections	be created	for a course for a given semester
Students	enroll	sections
Students	see	section's seat capacity
Faculty	assigned	section for a course
Grade	is kept track	in enrollment
Everyone	verify	personal profile
Students	see	final grades
Grades	broken by	assignments and exams
Points	based on	rubric
Students	go to	office hours
Answers	reviewed	in questions

3 Generalization/specialization

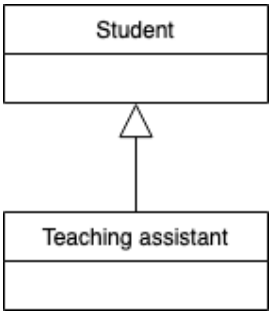
Evaluation widget is a widget, so evaluation widget is a specialization of widget, so as Youtube video, slide, text document, raw HTML. All of them can inherit same attributes of widget. Evaluation widget can be an essay assignment, a submission assignment, or an exam, so these three can be generalized into evaluation widget.



Student Profile is a personal profile, it has its own specific attributes instead of those attributes inherited from personal profile. Faculty profile is also a personal profile. Thus, student profile and faculty profile are the specialization of personal profile.



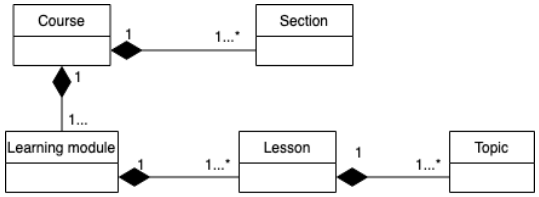
Teaching assistant is a student.



4 Association, aggregation and composition

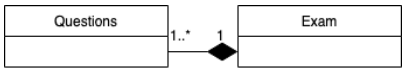
4.1 Composition

Courses contain learning modules. Without courses, learning modules cannot exit. Courses have one or more sections. Learning modules have one or more lessons, lessons have one or more topics

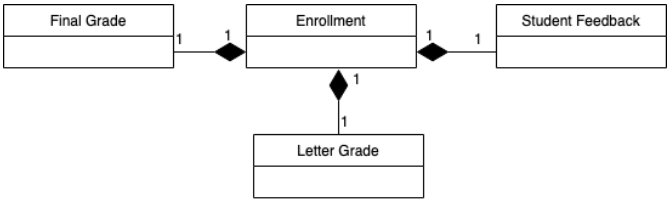


LMS provides many widgets. Without LMS, widgets cannot exist. LMS can have no widget, just a white page.

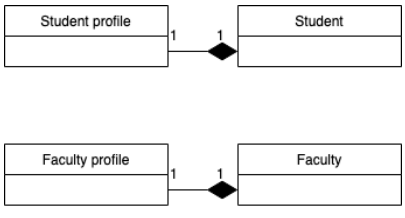
There are various types of questions in an exam. Exams have at least one question.



Students' progress can be tracked in the enrollment.

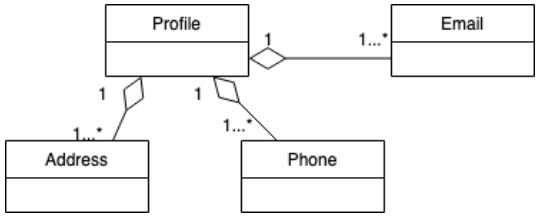


Students have their own student profiles, so do faculty.

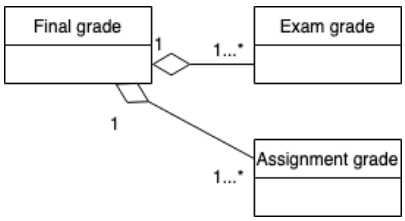


4.2 Aggregation

Profile contain username, password, first name, last name, emails, phones, and addresses. Even without profile, these things still exist. There can be multiple emails, phones, and addresses.

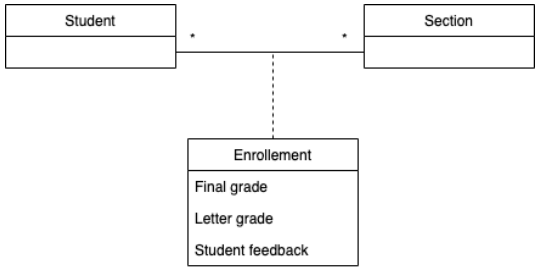


The student profile and faculty profile are in same situation. Final grades contain grades of each exams and assignments. Without final grade, all of exams' and assignments' grades are still exist. Final grades have at least one grade.

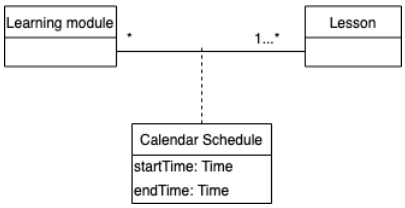


4.3 Association

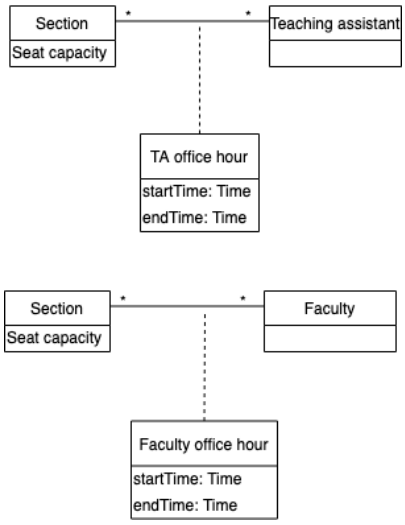
Students enroll in different sections. Enrollment as an association class establish a relationship between students and sections.



Modules and lessons can be rearranged into a different order based on the calendar schedule. Class calendar schedule is needed to get information which lesson of which module should be taken in what time.



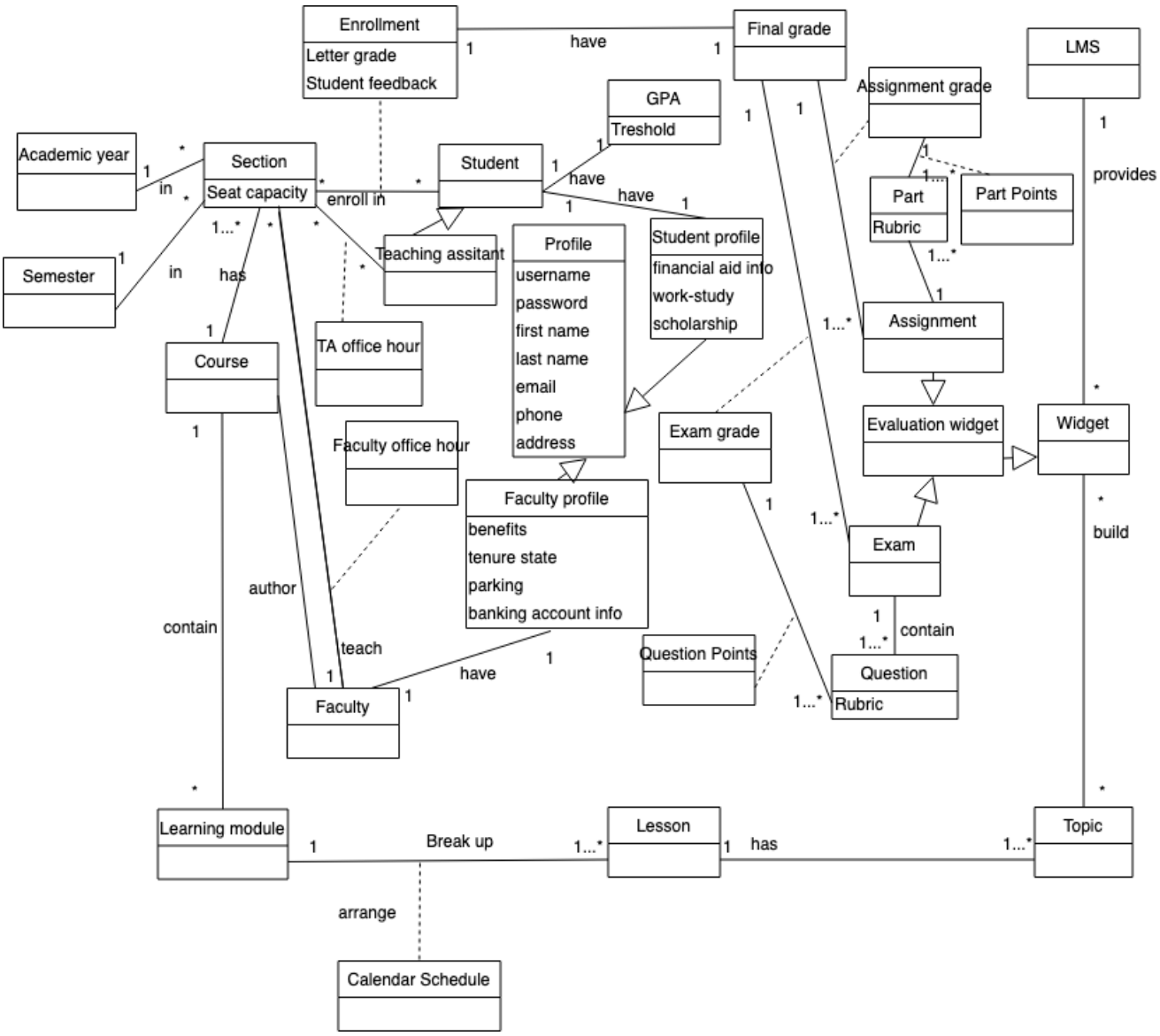
Teaching assistant office hour can be a association class to establish relationship between teaching assistant and sections. Faculty office hour can be a association class to establish relationship between faculty and sections.



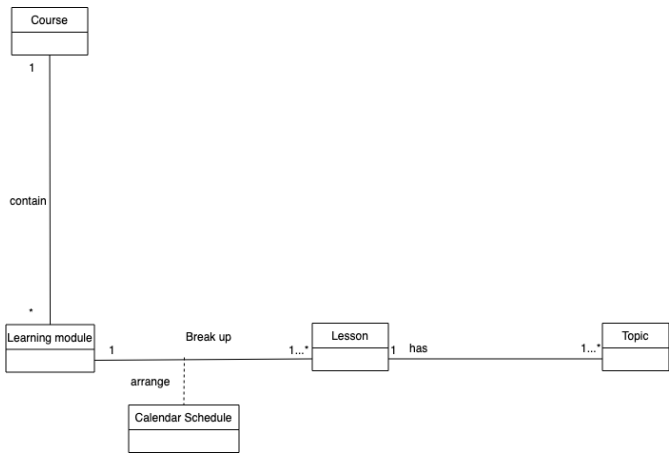
5 Classes vs. attributes analysis

5.1 Version 1

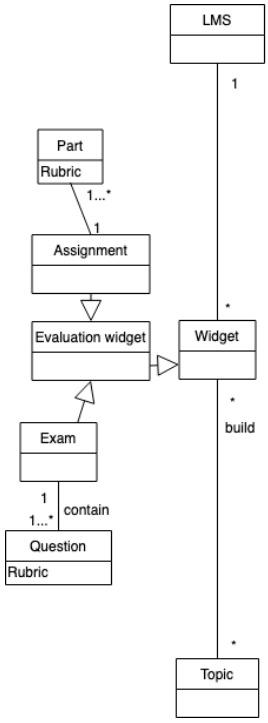
According to the problem statement, I create a 'naive' class diagram. Some obvious attributes were added into classes, such as some attributes of profile. Maybe later, some of those attributes are better to be a classes.



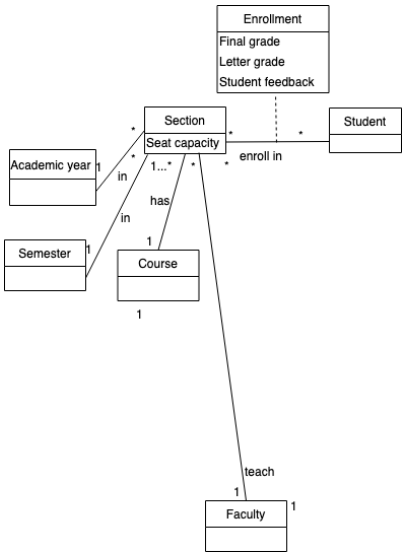
Explain: Because 'Faculty can author courses', 'Leaning modules are broken into lessons', 'Lessons have various of topics' and 'Calendar schedule' can be association class between modules and lessons, so I created this $part_1$.



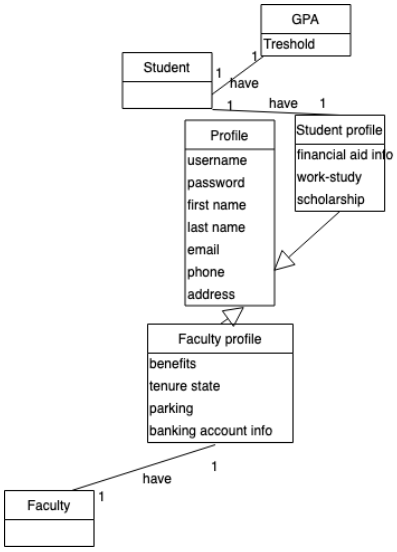
Since 'LMS provides many content widgets', 'Widgets build topics', 'Widgets come in variety of types' and 'Evaluation widgets can be assignment ore exam', according to the generalization, their relationship was built. Exam s also contain various type of questions, assignments contain several parts. Thus, this $part_2$ is created based on above reasons.



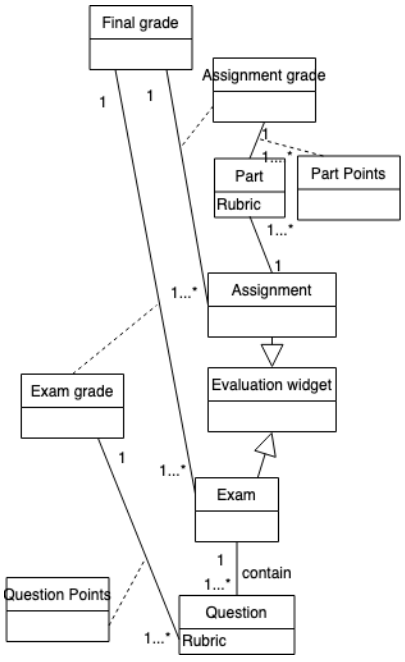
'The register office create several sections for a course for a given semester', 'some courses are only taught in particular semester in a given academic year', 'Faculty assigned to teach the section for a particular course' mean database should allow office, at the beginning of each year, to specify how many sections of each course it will offer for that year, and who will teach each section. Furthermore, students enroll in different sections, they have many-many relationship, so enrollment classes were added to reify this relationship. 'Students can see a section's seat capacity', so seat capacity should be section's attribute. Moreover, student progress, such as the final grade, letter grade, and student feedback, should be tracked in the enrollment, so let them as attribute of enrollment. According to the reasons above, $part_3$ is created.



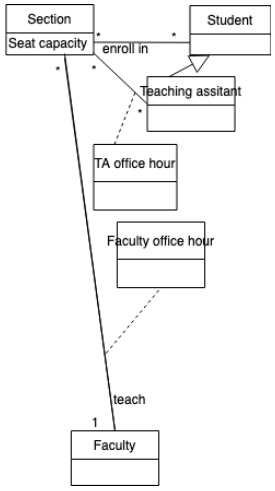
Personal profile can be specialized into student profile and faculty profile, each person has one profile. Students also have gpa in order to know if they can get scholarship. Threshold is only related to gpa, so threshold can be a attribute of gpa. Since above all, $part_4$ is built.



'Grades are broken by the assignments or exams', so there are relationships between final grades and assignments or exams, assignment grades or exam grades can build a relationship between them. 'Grades can be even down to points', so question points were built to establish relationship between exam grades and questions, part points built relationship between assignment grades and assignment parts. Even though exam grades, assignment grades, question points, part points are not mentioned in statement, I think they should be added. Thus $part_5$ was created.

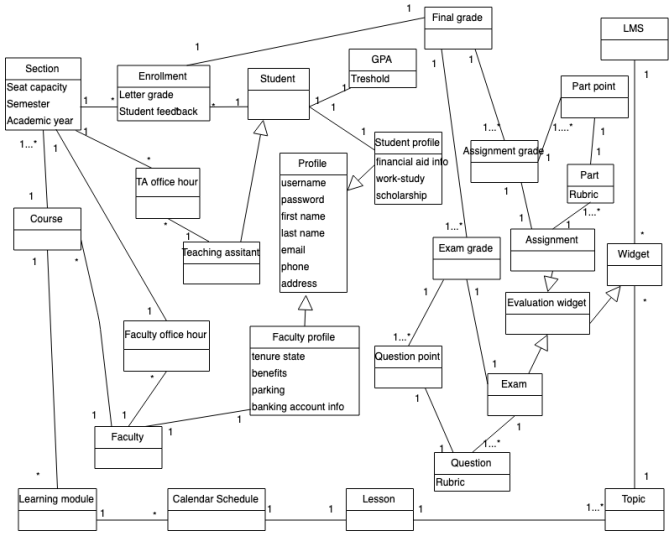


Since 'Students often go to office hour to review an evaluation with their instructor or teaching assistant', students need to know the office hour of their instructor or TA. So $part_6$ was built.



5.2 Version 2

All association classes were promoted into full classes. I got this diagram.

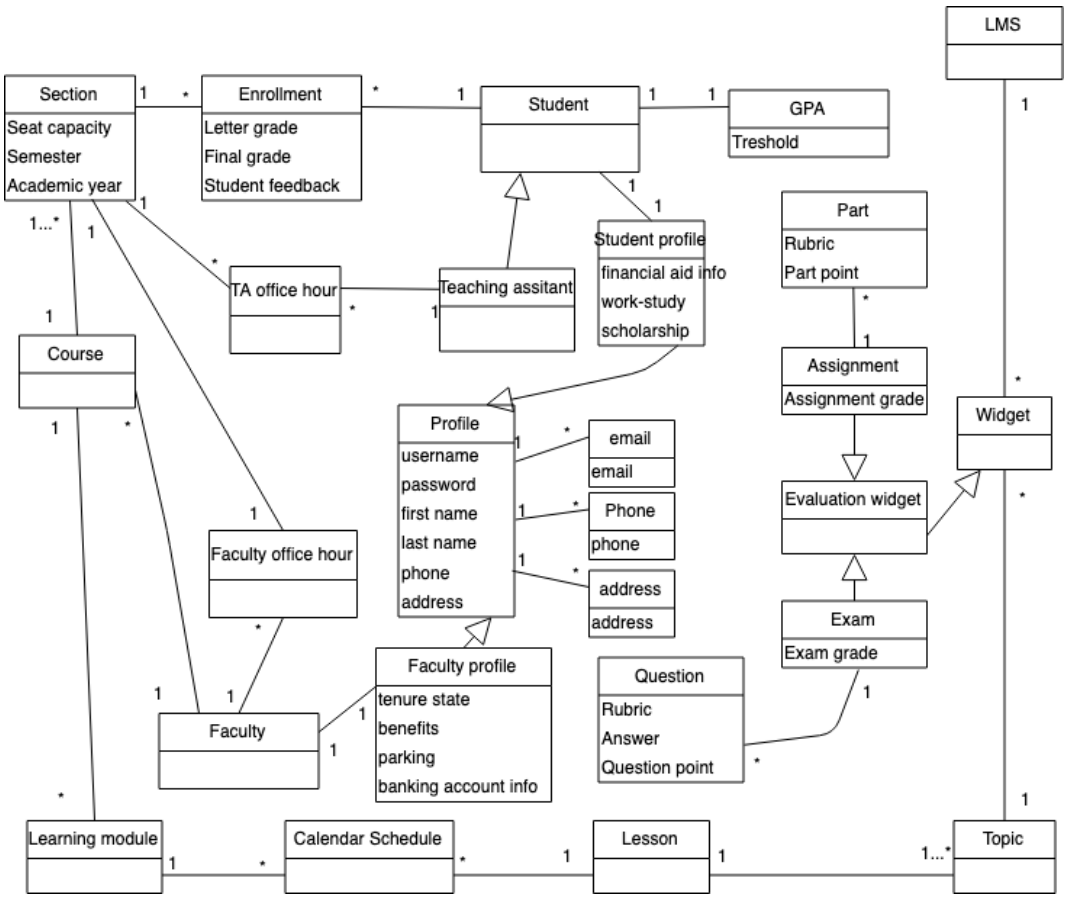


I found there are multiple redundant relationships. For example, student won't go to final grade to get their exam grades or assignment grade, then can go to the associated widgets to access exams or assignments if they want to know these grades. Further, student profiles are only related to students, so student profiles should be students' attribute, so are faculty profiles.

5.3 Version 3

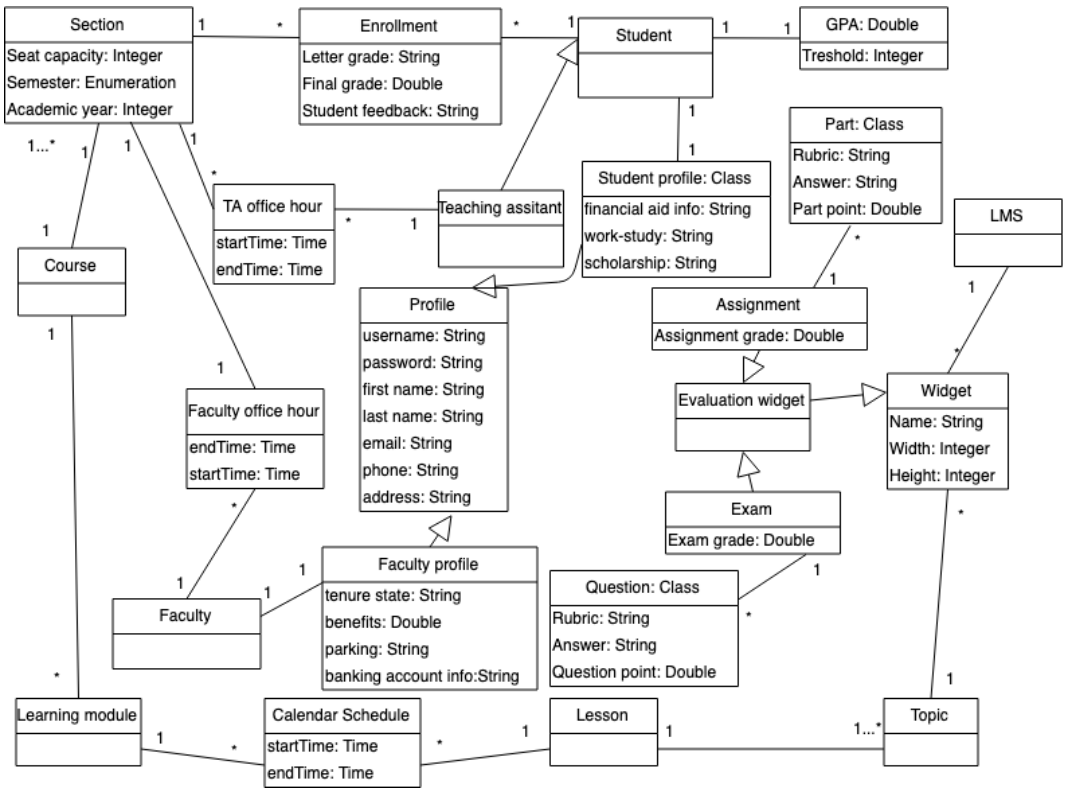
Because student profiles and faculty profiles have their own attributes, so I kept them as classes. Since users can provide multiple emails, phones and addresses, according to first normal form, them came out of profile as classes. GPA should be an attribute of student, but I want GPA contain an attribute called 'Threshold' so that student can see if they can get scholarship, so I kept GPA as a class.

After redundant relationships were removed, final class diagram was built.



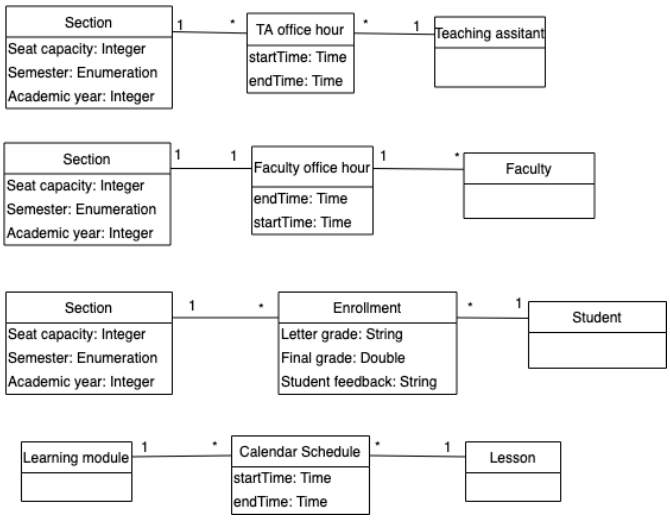
6 Correct data types

Specify every attributes data type on diagram.



7 Cardinality

There are four associations on diagram, the cardinality for each one would be:



8 Remove any inadequate or redundant relationships, entities or attributes

In my version 2 diagram, there are variety of inadequate relationships. For example, 'faculty can author courses' is inadequate, it should be 'faculty can author sections of a course they teach'.

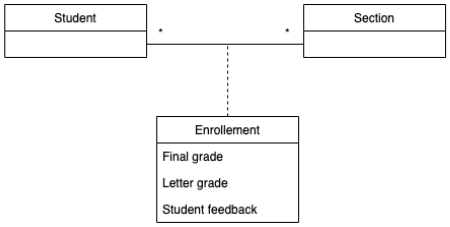
Widgets types, such as youtube videos, slides, text documents, raw HTML, are redundant. Questions

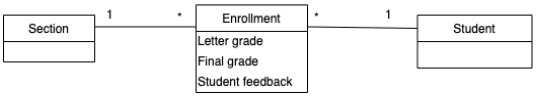
types, essay questions, multiple choice questions, fill in the blank questions, and many more types of questions, are also redundant.

The query 'Grades are neatly broken by the various assessments such as assignments and exams. Even down to the points they lost on a particular question based on a rubric that keeps track on how much each question was worth on an exam or how much a particular part of an assignment was worth.' is a little tricky, so I built a relationship between final grades and exam grades or assignments grades, in the end, i found these relationships were redundant, students can follow other two routes to get final grades and exam grades or assignment grades. So do exam grades and question points.

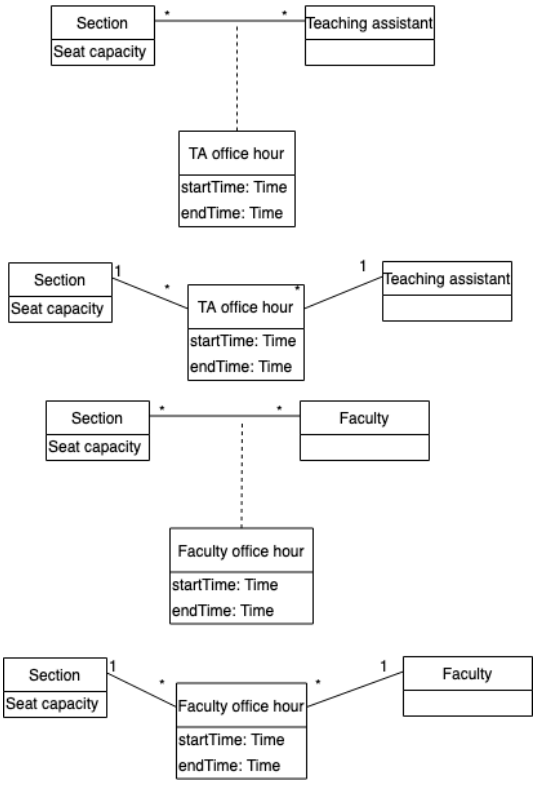
9 Reify

Students enroll in sections, they are many-many relationships, so an enrollment class was necessary to build to reify this many-many relationship. In the enrollment class, students can get final grade for he enroll section.

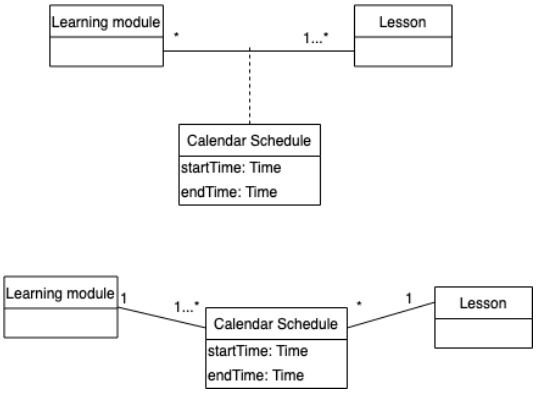




Teaching assistant office hour can be a association class to establish relationship between teaching assistant and sections. Faculty office hour can be a association class to establish relationship between faculty and sections.



Modules and lessons can be rearranged into a different order based on the calendar schedule. Class calendar schedule is needed to get information which lesson of which module should be taken in what time.



10 Prose

Extract nouns that are candidate classes or attributes, and extract verbs as candidate relations between classes. From now on, a 'naive' class diagram was built.

Students enroll in sections, they are many-many relationships, so an enrollment class was necessary to build to reify this many-many relationship. In the enrollment class, students can get final grade for he enroll section. Teaching assistant office hour can be a association class to establish relationship between teaching assistant and sections. Faculty office hour can be a association class to establish relationship between faculty and sections. Modules and lessons can be rearranged into a different order based on the calendar schedule. Class calendar schedule is needed to get information which lesson of which module should be taken in what time. Thus several association classes were created.

From now on, inadequate and redundant relationships should be removed. 'Faculty can author courses' is inadequate, it should be 'faculty can author sections of a course they teach'. Widgets types, such as youtube videos, slides, text documents, raw HTML, are redundant. Questions types, essay questions, multiple choice questions, fill in the blank questions, and many more types of questions, are also redundant. The query 'Grades are neatly broken by the various assessments such as assignments and exams. Even down to the points they lost on a particular question based on a rubric that keeps track on how much each question was worth on an exam or how much a particular part of an assignment was worth.' is a little tricky, so I built a relationship between final grades and exam grades or assignments grades, in the end, i found these relationships were redundant, students can follow other two routes to get final grades and exam grades or assignment grades. So do exam grades and question points.

Then, converting some classes into attributes, and adding them to classes. After correcting data types, final class diagram was created.

For the problem statement requirement, students can know the sections they enroll in, and know the office hour of faculty and TAs of that section. Students can see their final grades in enrollment. Students can review their evaluation on LMS through evaluation widgets to know the exams and assignments. In exam classes, student can also review questions of that exam, according to rubric and their answer, they will know whether this questions points went wrong.