Preamble

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Summary:	TA Management System: A database system for assigning TAs to CS courses.
Project idea link:	https://cs.rochester.edu/tars
Project location:	betaweb:/home/nbook/tnd

Domain Description

The old TARS (TA reporting system) is outdated. We propose to make a database to handle the sign up and management of lab TAs for CS courses. Upper level courses without labs with specific times will be handled. Professors will be able to approve specific students as TAs. Students who have completed the course will be able to sign up before the course begins to TA it. Administrators will be able to add, modify, and remove courses and other data. Integration with University of Rochester NetIDs may be possible. Students taking the course may be allowed to view the TAs approved for their course.

Use Cases

Case 1:

Paul is a senior in the University of Rochester computer science department who wants to TA a course that he had already taken. He signs up intending to get approved by the professor who teaches the course. Before the start of the course, the instructor, Dr. Boondoggle, can approve TAs.

Case 2:

Matt is a freshman at the University of Rochester who is taking an intro level CS course and wants to know who the TAs for his course is. The system should be able to show who are the approved TAs for the course.

Case 3:

Emily is the administrator assistant for the Computer Science department. She wants to schedule a workshop for CSC 173. She pulls the TA that is scheduled for the class and using their net-id she sends an email to him requesting times that he would be available to lead workshops. Once she hears back from them, she creates workshops that he will lead.

Case 4:

Emily is the administrator assistant for the Computer Science department. She needs to change the professor teaching a course for CSC 171 but wants to make sure that there will not be any conflicts for the time slot that she scheduled for that class and professor. She uses the system in order to fetch all the times that the designated professor is teaching next semester. She also uses the system to fetch all the 171 sections already scheduled. Using the System, she deletes the professor which is no longer teaching and adds the new professor to the system. If there are no conflicts, she leaves it alone, but if there is a conflict, she reschedules the section.

Sample English Queries

Case 1:

1. List the positions with times, room, and total positions for a specified course.
2. List the students wanting to sign up to TA a specific professor's class(es).

Case 2:

1. List the approved course TAs for a given course.
2. List the approved workshop leaders for a given course and the workshop weekday and time.

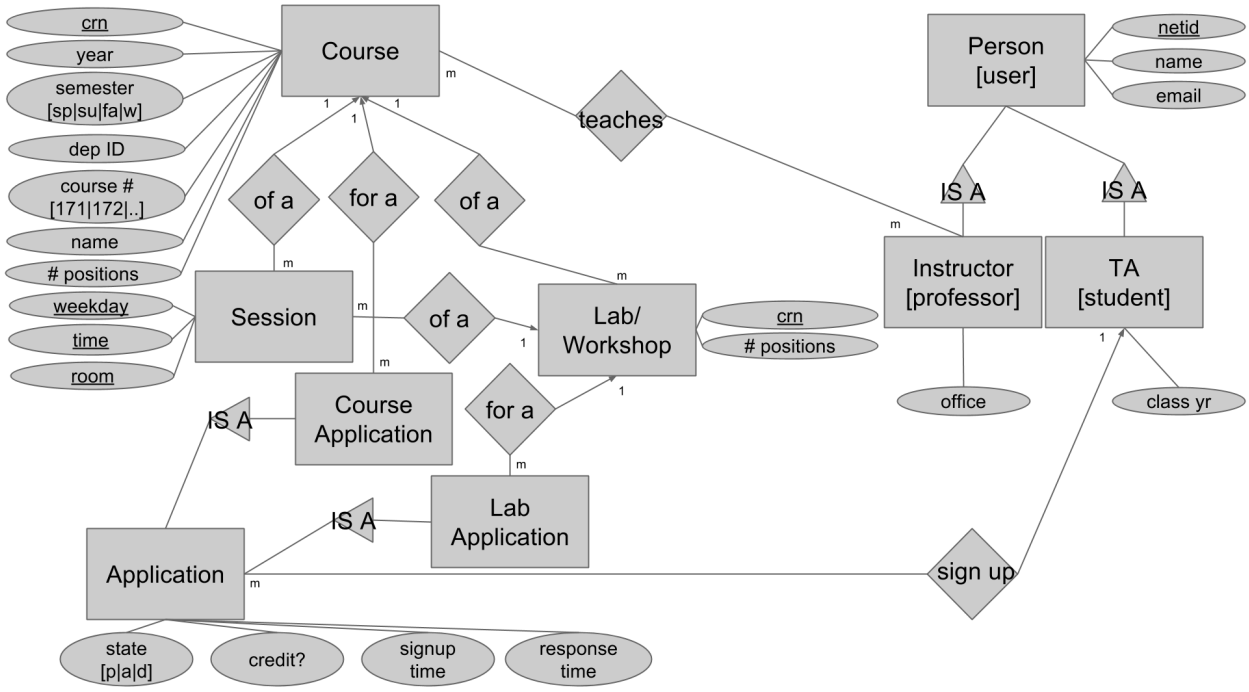
Case 3:

1. Retrieve email addresses for approved TAs for a specific course.
2. For the first workshop leader, create a workshop time, date and location.
3. Repeat for another workshop session if applicable.

Case 4:

1. List all the courses titles, lecture time, and lecture location that a specific professor is teaching.
2. List all sections time and lecture locations of a course being taught this semester.
3. Delete the name of the professor that is no longer teaching a section of the course.
4. Add the name of the new professor who is teaching the section of the course.
5. Delete and re-add new class times and lecture locations for the section if necessary.

Entity-Relation Diagram



Relations

Courses(<u>crn</u>, year, semester, deptId, number, name, numPositions)
Sessions(<u>wkday</u>, <u>time</u>, <u>room</u>) [ex: 171, 172, ...]
Workshops(<u>crn</u>, numPositions, coursecrn)
Instructors(<u>netid</u>, name, email, office)
TAs(<u>netid</u>, name, email, classYear)
CourseApplications(<u>coursecrn</u>, <u>taNetid</u>, signupTime, responseTime, state, forCredit)
WorkshopApplications(<u>workshopcrn</u>, <u>taNetid</u>, signupTime, responseTime, state, forCredit)

CourseSessions(<u>course</u>, <u>session</u>)
WorkshopSessions(<u>workshop</u>, <u>session</u>)
Teaches(<u>course</u>, <u>instructor</u>)

Sample Relational Algebra Queries

Case 1:

1. List the positions with times, room, and total positions for a specified course:
   "for CSC 171 next semester"
   R1 = $\sigma_{\text{year=2014 AND semester='fall' AND deptId='CSC' AND courseNumber=171}}$ (Courses)
   R2 = $\pi_{\text{wkday, time, room, numPositions}}$ (R1 $\bowtie$ CourseSessions)
   R3 = $\pi_{\text{wkday, time, room, W.numPositions}}$ (R1 $\bowtie$ Workshops $\bowtie$ WorkshopSessions)
   $\rightarrow$ R4 = R2 $\cup$ R3

2. List the students wanting to sign up to TA a specific professor's class(es):
   "Dr. Boondoggle's courses, in the fall"
   $R1 = \sigma_{\text{I.netid='boondoggle ' AND C.year=2014 AND C.semester='fall'}} (\text{Courses} \bowtie \text{Teaches} \bowtie \text{Instructors})$
   $\rightarrow \quad R2 = \pi_{\text{T.name, C.depId, C.number, C.name}} (\sigma_{\text{A.state='pending'}} (R1 \bowtie \text{CourseApplications} \bowtie \text{TAs}))$

Case 2:

1. List the approved course TAs for a given course:
   "for CSC 173 in the fall"
   $R1 = \sigma_{\text{year=2014 AND semester='fall' AND depId='CSC' AND courseNumber=173}} (\text{Courses})$
   $R2 = \sigma_{\text{A.state='approved'}} (R1 \bowtie \text{CourseApplications})$
   $\rightarrow \quad R3 = \pi_{\text{T.name}} (R2 \bowtie \text{TAs})$
2. List the approved workshop leaders for a given course and the workshop weekday and time:
   "for CSC 172 in the spring"
   $R1 = \sigma_{\text{year=2015 AND semester='spring' AND depId='CSC' AND courseNumber=172}} (\text{Courses})$
   $R2 = \sigma_{\text{A.state='approved'}} (R1 \bowtie \text{Workshops} \bowtie \text{WorkshopApplications})$
   $\rightarrow \quad R3 = \pi_{\text{T.name}} (R2 \bowtie \text{TAs})$

Case 3:

1. Retrieve email addresses for approved TAs for a specific course:
   "for CSC 173 in the fall"
   $R1 = \sigma_{\text{year=2014 AND semester='fall' AND depId='CSC' AND courseNumber=173}} (\text{Courses})$
   $R2 = \sigma_{\text{A.state='approved'}} (R1 \bowtie \text{CourseApplications})$
   $R3 = \sigma_{\text{A.state='approved'}} (R1 \bowtie \text{Workshops} \bowtie \text{WorkshopApplications})$
   $\rightarrow \quad R4 = \pi_{\text{T.email}} ((R2 \bowtie \text{TAs}) \cup (R3 \bowtie \text{TAs}))$

Case 4:

1. List all the course titles, lecture time and location that a specific professor is teaching:
   "Dr. Boondoggle's courses this semester"
   $R1 = \sigma_{\text{netid='boondoggle'}} (\text{Instructors})$
   $R2 = R1 \bowtie \text{Teaches} \bowtie \text{Courses} \bowtie \text{Sessions}$
   $\rightarrow \quad R3 = \pi_{\text{C.name, S.wkday, S.time, S.room}} (\sigma_{\text{semester='spring' AND year=2014}} (R2))$
2. List all session times and lecture locations of a course being taught this semester:
   "Dr. Boondoggle's Intro to AI, CSC 240"
   $R1 = \sigma_{\text{depId= 'CSC' AND number=240 AND year=2014 AND semester='spring'}} (\text{Course} \bowtie \text{Session})$
   $\rightarrow \quad R2 = \pi_{\text{S.wkday, S.time, S.room}} (R1)$

Functional Dependencies 1

For Courses:

crn → year
crn → semester
crn → deptID
crn → courseNumber
crn → numPosititons

For Workshops:

crn → numPositions
crn → session
crn → course

For Instructors:

netid → name
netid → email
netid → office

For TAs:

netid → name
netid → email
netid → classYear

For CourseApplications:

coursecrn, taNetid → signupTime
coursecrn, taNetid → responseTime
coursecrn, taNetid → state
coursecrn, taNetid → forCredit

For WorkshopApplications:

workshopcrn, taNetid → signupTime
workshopcrn, taNetid → responseTime
workshopcrn, taNetid → state
workshopcrn, taNetid → forCredit

For CourseSessions:

course → session

For WorkshopSessions:

workshop → session

For Teaches:

course → instructor

Proof of Normal Form 1
Our schema is in fourth normal form, because all multivalued dependencies are trivial.

Relational Schema 2
Since our schema is already in fourth normal form, we do not need to modify the schema.

Functional Dependencies 2
Since our schema is already normalized, we are done.

Proof of Normal Form 2
Again, our schema is normalized, so this proof is the same as the above.

Sample Queries 2
Our relational algebra is identical to the previous.