COBA/SITC Course Scheduler

SE14F

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I. DESIGN

A. Introduction

1. **Problem Statement:**
   After students are enrolled for the next semester, the process to move sections is difficult.

2. **Mission:**
   Provide a web based application that searches for the most efficient time to hold a rescheduled course in a student schedule.

3. **Design Goals:**

- Help identify possible faults in our understanding about the overall system
- Help assist developers to identify areas where we can design for change.
- Provide the client with an overall outline how how the web app will be laid out
- Help identify and point out areas where security methods need to be implemented
- Express how this web app will meet the needs and goals of our client

4. **Estimated Time of Completion:**
   The magnitude of this project should take 90 - 120 hours to complete.

B. Architecture

1. **Input/Output:**
   Users will be able to enter in a CRN and a potential time change. The results will consist of the total number of conflicts and which classes are involved in them. The results with details will show which student conflicts are important by student classification and the frequency a course is offered. This will be represented in calendar form, day of the week by time. Each entry will be highlighted a color of severity based off of the aforementioned measure of importance. There will also be a similar list of room availability in case a class needs to relocate as well.

2. **Platform/Language:**
   For this project we will be using a system that runs on the Internet.We have chosen to use PHP as our main language for our web application. We will be running our web app on a server with a LAMP stack.

3. **Data:**
   One of the largest portions of this project is the database. In this database will be the list of classes by CRN along with each classes' student roster, time of day, day of the week, and room number. There will also be each student's schedule, transcript, and classification. This information is highly sensitive so security must be provided and will be enforced through an application level authentication. The database will be interfacing with banner to get information from along with the front end of our project to print out this information.

We will be using a standard relational database called mysql. This design choice is due to the fact that we are using a LAMP/WAMP stack. It is used in many companies and open source projects and because of that it has been widely tested and is somewhat secure. In the future if developers decide to go with a different database system it will have minimal effect on our design. The only modules that will be affected are our api and and the database config file. Our view will not be affected because they only call the api.

There will be five entities with several attributes. The first table will have the details of 4771 students at ACU. We will also need a course table. The third is the student schedule table, typically ranging from 3-6 courses. We need this entity in order to implement a many to many relationship between the students and sections table. The last table is a transcript, which provides all the information of the classes the student has taken.

4. Sample Schema

```
CREATE TABLE section(
 crn int primary key,
 start_date date,
 end_date date,
 days varchar(5),
 start_time time,
 end_time time,
 department varchar(20),
 room_num int,
 enroll_max int,
 enroll_now int,
 instructor varchar(30),
 cost int,
 paid int,
 course_id int
);

CREATE TABLE schedule(
 student_id int,
 section_id int,
 primary key(student_id, section_id)
);

CREATE TABLE student(
 banner int primary key,
 email varchar(40),
 f_name varchar(18),
 l_name varchar(18),
 classification varchar(10),
 major varchar(20),
 expected_graduation int
);
```

```
CREATE TABLE transcript(
 id int primary key,
 student_id int,
 section_id int,
 grade varchar(1)
);

CREATE TABLE course(
 id int primary key,
 prefix varchar(5),
 course_num varchar(3),
 prereqs_id int
);
```

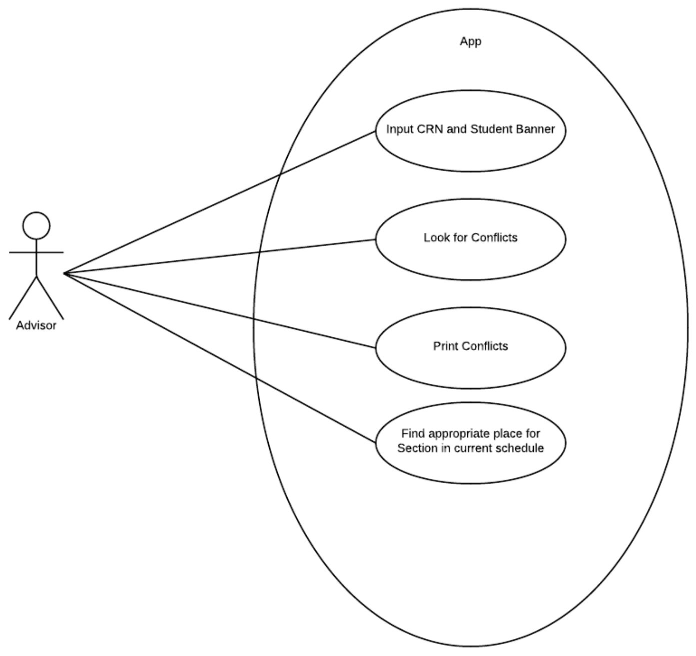
C. Code

1. **Introduction:**
   Languages we will be using in our project include, markup, stylesheets. HTML, Javascript and CSS for front-end. We will also be using PHP for back-end.

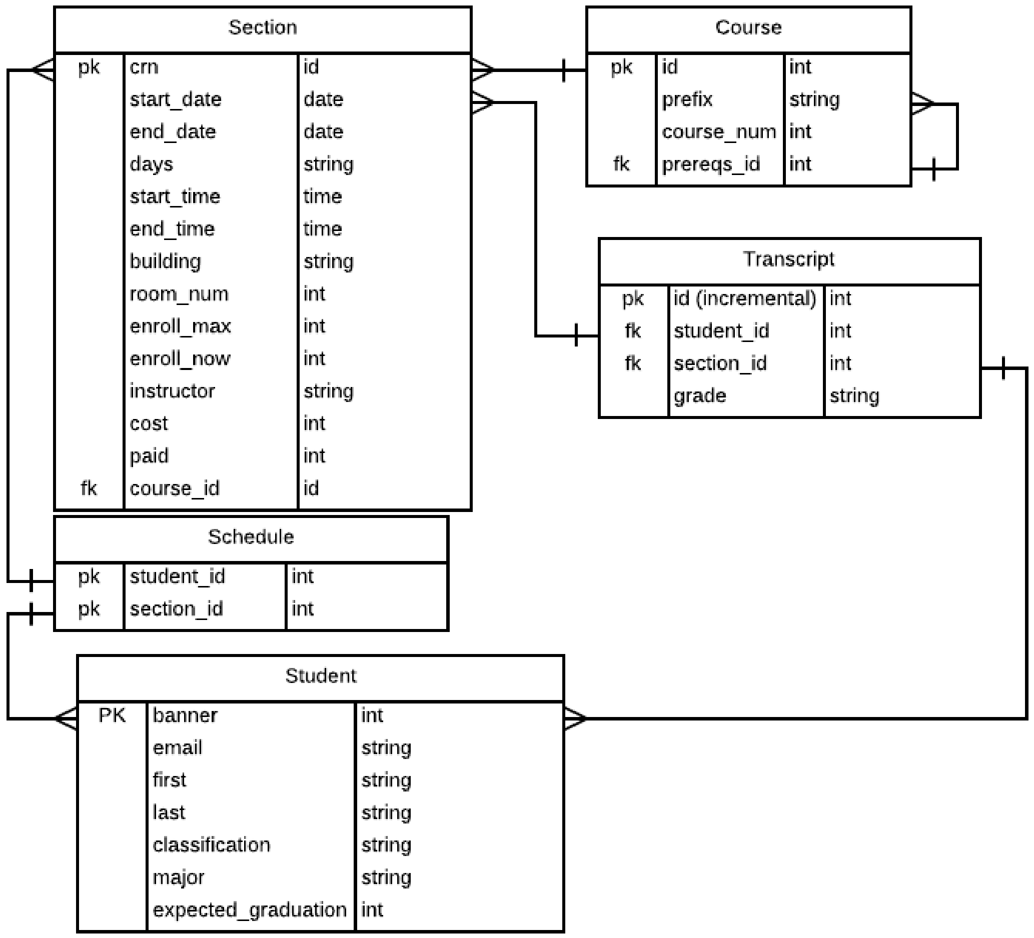
2. **Frameworks:**
   Bootstrap:
   Bootstrap (http://getbootstrap.com/) is a web framework used to make front-end development easy and fast. This will help us create clean user interfaces.

3. **Google Calendar API:**
   We will use the FullCalendar API (http://fullcalendar.io/docs/) in our application in order to show the results of our clients queries into the system in a visually appealing way

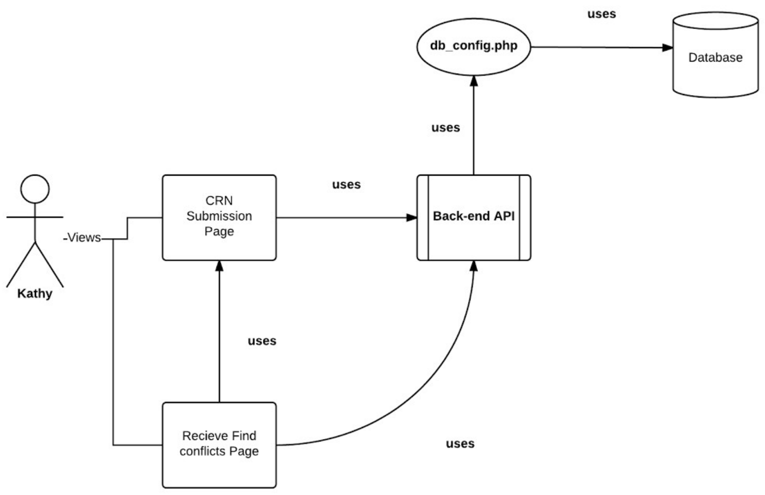
4. **User Case Diagram (Advisor):**


App
Input CRN and Student Banner
Look for Conflicts
Print Conflicts
Find appropriate place for Section in current schedule
Advisor

5. **ERD Diagram:**



6. **UML Diagram:**



7. **Views:**

- *Log in with administrative username and password:*
  User inputs their username and password and credentials are verified
- *Submit CRN View:*
  User Kathy submits CRN and desired time for course specified. Returns a Receive/ Find conflict view
- *Receive/ Find Conflicts View:*
  The module displays the course conflicts that have occurred based on what user submits via CRN View.

8. **API (Application Programming Interface):**
   We currently have one API that could later be integrated into banner or even replaced by banner if needed.

- *Back-end/API:*
  We will create an API with availible function calls that return required data from the database. These will essentially be a series of sql queries on the database.

D. Operation

1. **User Types:**
- Administrator: Data and User Management
- Advisor: searches conflicts for a schedule in a certain semester. (not the ones in the past)
- Students: just like advisors, but less output due to limited permissions.

2. **Scenarios:**
- Inputs student data(banner, classification, first name, last name, and a list of sections)
- Search in database for conflicts by:

a. time

b. classroom availability

- Output conflicts for next semester.
- In Spring, output conflicts in summer.

E. Miscelanea

This project would ideally be distributed to students, not just administrators and advisors so that students can check conflicts with their own schedule. We can easily abstract the portion that finds conflicts from the entire banner database and every other student schedule so that only that bit of code would be utilized by these unauthorized figures. Therefore, the only changes that would be made would be authorization. This would accept student username and password and see they are not faculty, and automatically limiting what's outputted to be just information that pertains to them,

Debugging is always a handful, but hopefully, by following the incrementality principle of design we can test with portions of the project to avoid searching through every bit we designed for some small crack.

F. Bibliography

Ghezzi, Carlo, Mehdi Jazayeri, and Dino Mandrioli. *Fundamentals of Software Engineering*. Englewood Cliffs, NJ: Prentice Hall, 1991. Print.

"Writing a Good Software Design Document." *BitFormation Consulting* -. N.p., n.d. Web. 06 Oct. 2014.

II. SPECIFICATIONS

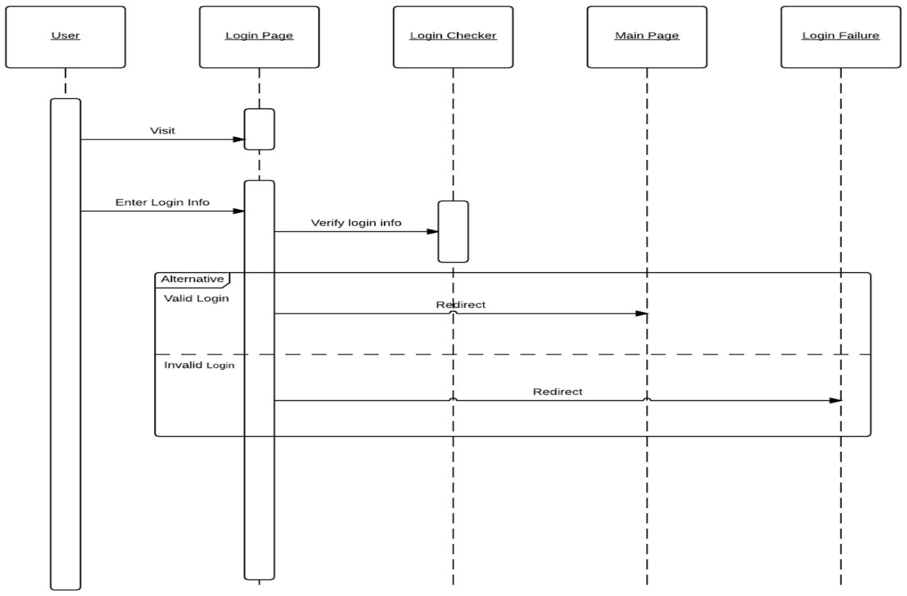
A. Overview

There is no automated way of comparing student schedules to see the best time to move a class. The client specified that after students are enrolled in a class it is difficult to move class times. These class times conflict with other classes. This project will provide Karen with a web based application that checks student schedules to see the best time to hold a rescheduled course.

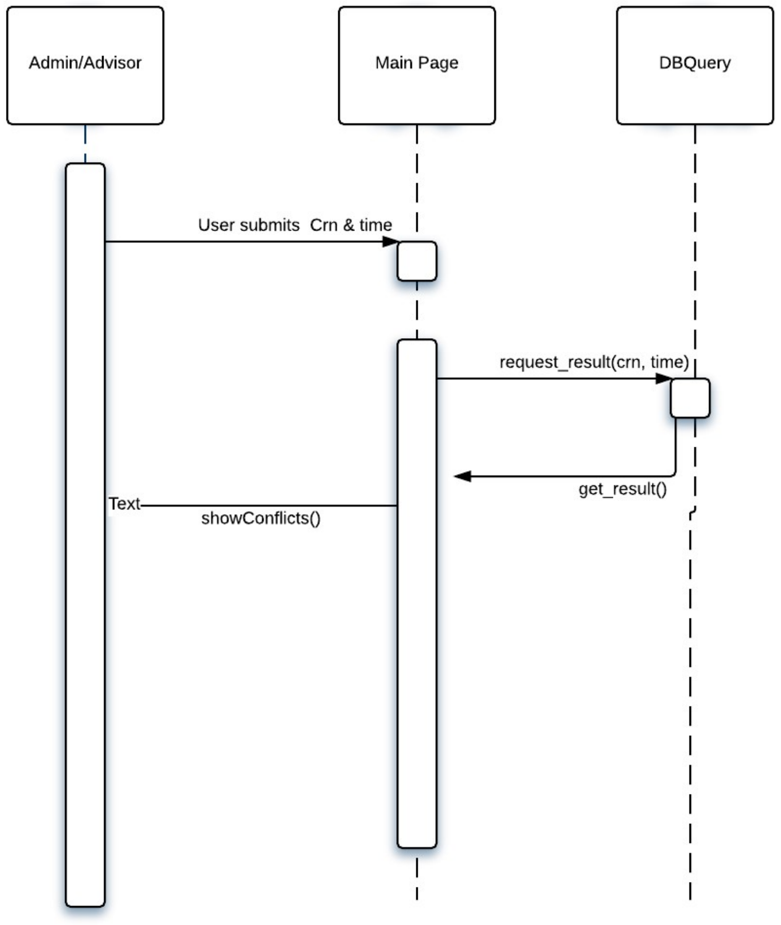
B. Scenarios

- Advisor is trying to log in but forgot her password. She clicks on the link "Forgot your Password?" Then her email address is requested. She types in her email address and then the password reset request has been sent to her email.
- Same thing happens if she forgets her username.

Sequence Diagram for username and password validation:



- Advisor or administrator enters in course number and time of day. New view appears showing a grid with time on the vertical axis and days of the week on the horizontal axis. Each grid slot will show a color of severity based on the level of conflicts.
  Crn and time submission:



C. Extra Features

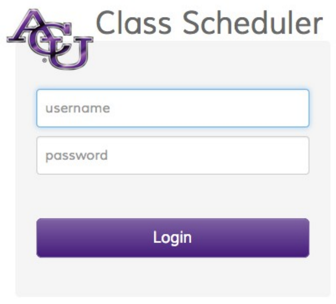
- If time allows it, we will include, along with student schedule conflicts, conflicts with classrooms based off of class size and/or room availability.
- Allow professors to test out class time changes rather than make advisors and administrators do it.
- Make the application usable by students to test out adding a class to their schedule when getting ready to register.

D. Views

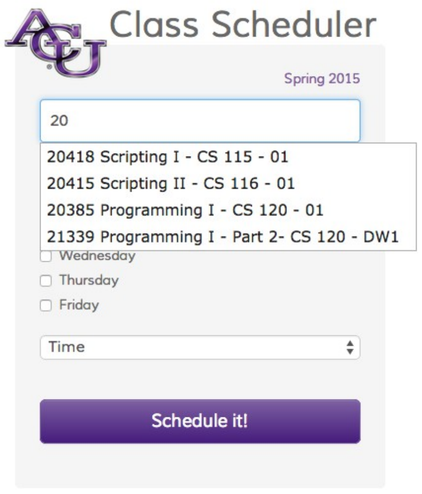
- Log-in page for administrators/advisors
- Submit CRN view should contain a form box for the CRN and a drop down box for Kathy to be able to select time desired for the specified course
- Find conflict view should display course conflict. Specifically a calendar should be displayed from our calendar api that shows conflicting times in red usable times in green. In the red, if the user clicks it, all of the conflicts would appear

E. View Samples

1. **Log In View:**

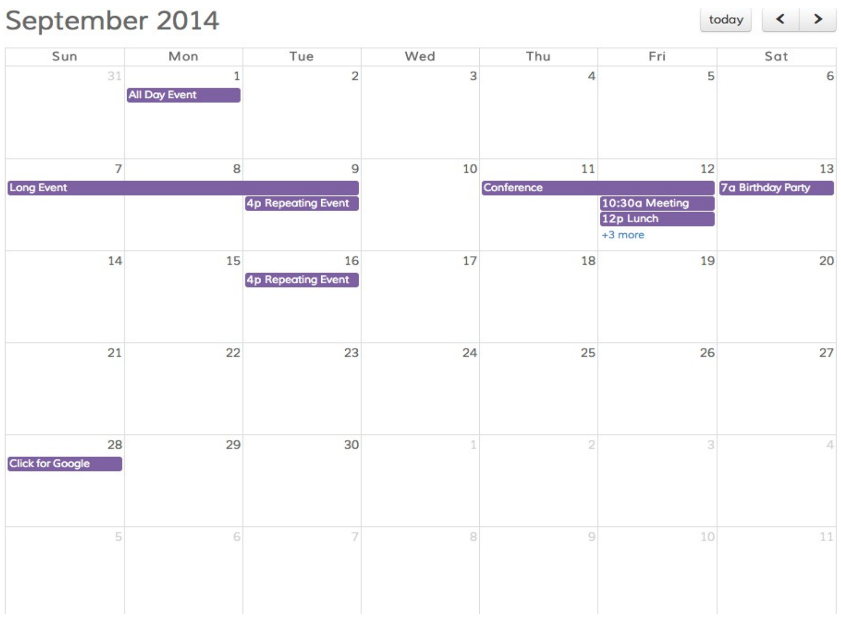


2. CRN, Time, and Day Submission View:



20418 Scripting I - CS 115 - 01
20415 Scripting II - CS 116 - 01
20385 Programming I - CS 120 - 01
21339 Programming I - Part 2- CS 120 - DW1

3. **Calendar Conflict View:**

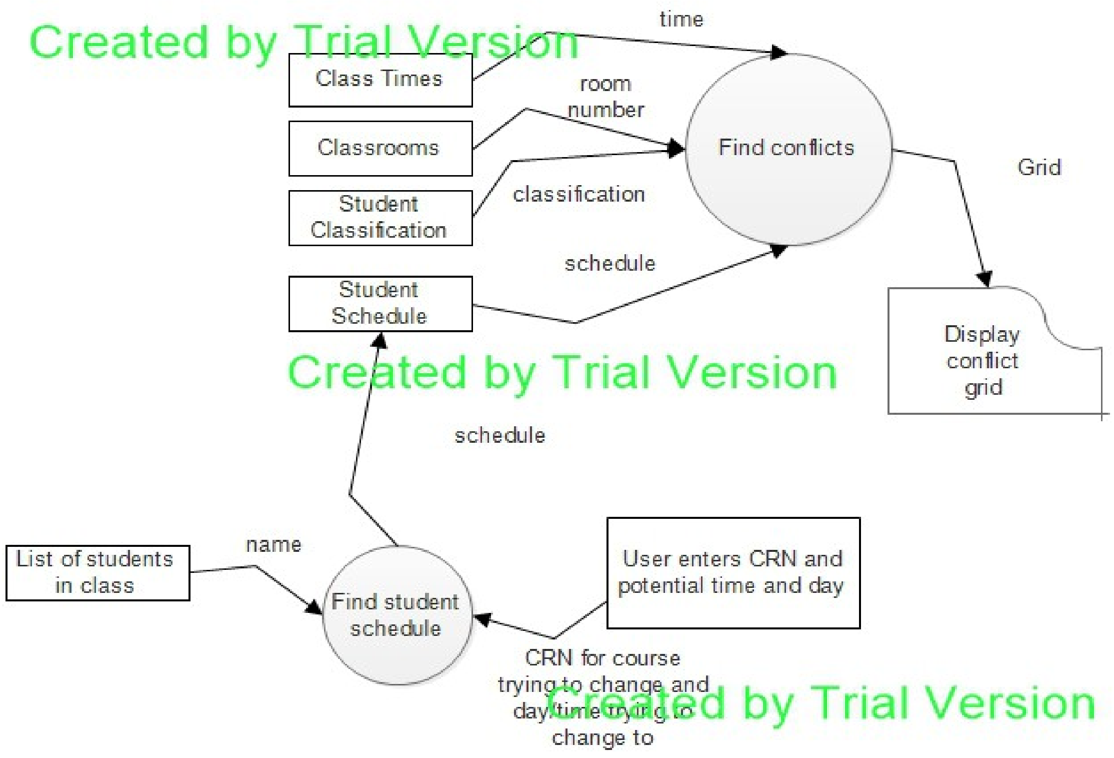


September 2014

today < >

Sun	Mon	Tue	Wed	Thu	Fri	Sat
31	1 All Day Event	2	3	4	5	6
7 Long Event	8 Long Event	9 Long Event 4p Repeating Event	10	11 Conference	12 Conference 10:30a Meeting 12p Lunch +3 more	13 7a Birthday Party
14	15	16 4p Repeating Event	17	18	19	20
21	22	23	24	25	26	27
28 Click for Google	29	30	1	2	3	4
5	6	7	8	9	10	11

F. **Data Flow Diagram**



III. VERIFICATIONS

A. Black Box Testing

1. **Feature:** The user should be able to log into the system.

Scenario: User submits correct username and password

```
Given   user is on login page
And     user types correct username
And     user types correct password
And     user clicks the login button
Then    the user logs into the system
Then    scheduler view page should display
```

Scenario: User submits incorrect username

```
Given   user is on login page
And     user types correct username
And     user types some password
And     user clicks the login button
Then    page returns invalid username or password error
```

Scenario: User submits incorrect password

```
Given   user is on login page
And     user types some username
And     user types correct password
And     user clicks the login button
Then    page returns invalid username or password error
```

Scenario: User submits password and no username

```
Given   user is on login page
And     user types username
And     user clicks the login button
Then    page no specified username error
```

Scenario: User submits username and no password

```
Given   user is on login page
And     user types password
And     user clicks the login button
Then    page no specified password error
```

2. **Feature:** The user inputs CRN,requested time, days (Monday,Tuesday,etc.) and sent to database

Scenario: Successful storing input from webpage to PHP file

```
Given   there are no current schedule conflicts with inputted CRN
When    I inputted 123456, 10:00-11:00, Monday (checked), Wednesday
        (checked), Friday (checked)
Then    the variables (CRN, beg_time, end_time, days[i]) should have
123456, 10:00,11:00, [Monday Wednesday Friday] respectively
```

3. **Feature:** Finding Conflicts

Scenario: Data from PHP conflicted to time data in database

Given	data from php
When	there is a time conflict
Then	time that is conflicted is stored in a PHP variable

Scenario: Data from PHP conflicted to room_num in database

Given	data from php
When	CRN class room number conflicts to another CRN classroom number
Then	room number that is conflicted is stored in a PHP variable

Scenario: Data from PHP conflicted to days in database?

Given	data from php
When	there is a day conflict (no time availability on that day)
Then	days that are conflicted are stored in a PHP array

4. **Feature:** Conflict possibilities. User inputs CRN, beginning and end time, days of the week to test

Scenario: No conflicts with student schedules

Given	database of student schedules
And	course catalogue
When	user inputs course number and testing time and day
Then	new screen appears dictating no conflicts with the option of viewing the calendar grid of severities
And	The time block specified will be outlined and shaded white to dictate no severity

Scenario: Conflict with senior's schedule, not needed for graduation

Given	database of student schedules
And	course catalogue
And	catalogue year
When	user inputs course number and testing time and day
Then	new screen appears with calendar grid, with every grid either white, green, yellow, orange, or red
And	The time block specified will be outlined and shaded yellow to dictate a low severity

Scenario: Conflict with senior's schedule, needed for graduation, offered next semester student will attend school

Given	database of student schedules
And	course catalogue
And	catalogue year
And	graduation date
When	user inputs course number and testing time and day
Then	new screen appears with calendar grid, with every grid either white,green, yellow, orange, or red

And The time block specified will be outlined and shaded orange to dictate a high severity

Scenario: Conflict with senior's schedule, needed for graduation, not offered next semester student will attend school

Given database of student schedules
And course catalogue
And catalogue year
And graduation date
When user inputs course number and testing time and day
Then new screen appears with calendar grid, with every grid either white, green, yellow, orange, or red
And The time block specified will be outlined and shaded red to dictate the highest severity

Scenario: Conflict with junior's schedule, not needed for graduation

Given database of student schedules, course catalogue, and catalogue year
When user inputs course number and testing time and day
Then new screen appears with calendar grid, with every grid either white, green, yellow, orange, or red. The time block specified will be outlined and shaded yellow to dictate a low severity

Scenario: Conflict with junior's schedule, needed for graduation

Given database of student schedules
And course catalogue
And catalogue year
When user inputs course number and testing time and day
Then new screen appears with calendar grid, with every grid either white, green, yellow, orange, or red
And The time block specified will be outlined and shaded orange to dictate a high severity

Scenario: Conflict with sophomore's schedule, not needed for graduation

Given database of student schedules
And course catalogue
And catalogue year
When user inputs course number and testing time and day
Then new screen appears with calendar grid with every grid either white, green, yellow, orange, or red
And The time block specified will be outlined and shaded green to dictate a very low severity

Scenario: Conflict with sophomore's schedule, needed for graduation

Given database of student schedules
And course catalogue
And catalogue year

```
        When    user inputs course number and testing time and day
        Then    new screen appears with calendar grid, with every grid either white,
                        green, yellow, orange, or red
        And     The time block specified will be outlined and shaded yellow to
                dictate a low severity

    Scenario: Conflict with freshman’s schedule, not needed for graduation
        Given   database of student schedules
        And     course catalogue
        And     catalogue year
        When    user inputs course number and testing time and day
        Then    new screen appears with calendar grid, with every grid either white,
                green, yellow, orange, or red
        And     The time block specified will be outlined and shaded green to
                dictate a very low severity

    Scenario: Conflict with freshman’s schedule, needed for graduation
        Given   database of student schedules
        And     course catalogue
        And     catalogue year
        When    user inputs course number and testing time and day
        Then    new screen appears with calendar grid, with every grid either white,
                        green, yellow, orange, or red
        And     The time block specified will be outlined and shaded yellow to
                dictate a low severity

    Scenario: Conflict with multiple students
        Given   database of student schedules
        And     course catalogue
        And     catalogue year
        And     graduation date
        When    user inputs course number and testing time and day
        Then    new screen appears with calendar grid, with every grid either white,
                        green, yellow, orange, or red
        And     The time block specified will be outlined and shaded the color of the
                        highest severity amongst the students
```

5. **Step Definitions to be implemented:**

```
Given(/^there are no current schedule conflicts with inputted CRN$/) do
          pending # express the regexp above with the code you wish you had
        end

When(/^I inputted (\d+), (\d+) (\d+)\-(\d+) (\d+), Monday \(checked\), Wednesday\(checked\),
Friday \(checked\)$/) do |arg1, arg2, arg3, arg4, arg5|
  pending # express the regexp above with the code you wish you had
end
```

```
Then(/^the variables \(CRN, beg_time, end_time, days\[i\]\) should have (\d+), (\d+) (\d+),(\d+)
(\d+), \[Monday Wednesday Friday\] respectively$/) do |arg1, arg2, arg3, arg4, arg5|
  pending # express the regexp above with the code you wish you had
end

Given(/^database of student schedules$/) do
  pending # express the regexp above with the code you wish you had
end

Given(/^course catalogue$/) do
  pending # express the regexp above with the code you wish you had
end

When(/^user inputs course number and testing time and day$/) do
  pending # express the regexp above with the code you wish you had
end

Then(/^new screen appears dictating no conflicts with the option of viewing the calendar grid of
severities$/) do
  pending # express the regexp above with the code you wish you had
end

Then(/^The time block specified will be outlined and shaded white to dictate no severity$/) do
  pending # express the regexp above with the code you wish you had
end

Given(/^catalogue year$/) do
  pending # express the regexp above with the code you wish you had
end

Then(/^new screen appears with calendar grid, with every grid either white, green, yellow, orange,
or red$/) do
  pending # express the regexp above with the code you wish you had
end

Then(/^The time block specified will be outlined and shaded yellow to dictate a low severity$/)
do
  pending # express the regexp above with the code you wish you had
end

Given(/^graduation date$/) do
  pending # express the regexp above with the code you wish you had
end
```

```
Then(/^The time block specified will be outlined and shaded orange to dictate a high severity$/)
do
  pending # express the regexp above with the code you wish you had
end

Then(/^The time block specified will be outlined and shaded red to dictate the highest severity$/)
do
  pending # express the regexp above with the code you wish you had
end

Given(/^database of student schedules, course catalogue, and catalogue year$/) do
  pending # express the regexp above with the code you wish you had
end

Then(/^new screen appears with calendar grid, with every grid either white, green, yellow, orange,
or red\. The time block specified will be outlined and shaded yellow to dictate a low severity$/)
do
  pending # express the regexp above with the code you wish you had
end

Then(/^new screen appears with calendar grid with every grid either white, green, yellow, orange,
or red dictate a very low severity$/) do
  pending # express the regexp above with the code you wish you had
end

Then(/^The time block specified will be outlined and shaded green to dictate a very low
severity$/) do
  pending # express the regexp above with the code you wish you had
end

Then(/^The time block specified will be outlined and shaded the color of the highest severity
amongst the students$/) do
  pending # express the regexp above with the code you wish you had
end

Given(/^user is on login page$/) do
  pending # express the regexp above with the code you wish you had
end

Given(/^user types correct username$/) do
  pending # express the regexp above with the code you wish you had
end

Given(/^user types correct password$/) do
  pending # express the regexp above with the code you wish you had
end
```

```
Given(/^user clicks the login button$/) do
  pending # express the regexp above with the code you wish you had
end

Then(/^the user logs into the system$/) do
  pending # express the regexp above with the code you wish you had
end

Then(/^scheduler view page should display$/) do
  pending # express the regexp above with the code you wish you had
end

Given(/^user types some password$/) do
  pending # express the regexp above with the code you wish you had
end

Then(/^page returns invalid username or password error$/) do
  pending # express the regexp above with the code you wish you had
end

Given(/^user types some username$/) do
  pending # express the regexp above with the code you wish you had
end

Given(/^user types username$/) do
  pending # express the regexp above with the code you wish you had
end

Then(/^page no specified username error$/) do
  pending # express the regexp above with the code you wish you had
end

Given(/^user types password$/) do
  pending # express the regexp above with the code you wish you had
end

Then(/^page no specified password error$/) do
  pending # express the regexp above with the code you wish you had
end
```

B. Module Testing

1. **Sign-in-Testing**

   Tests sign-in page if the sign-in data is submitted to the PHP files
2. **CRN-sending-Testing**

   Tests if the CRN data got sent to the PHP files
3. **Color-Coded-Testing**

   Tests the FullCalendar for appropriate color of certain conflicts displayed on it. The testing fails if the Calendar has a wrong color for a certain conflict.

C. Integration Testing

1. **Log-in Testing**

   Tests the log-in PHP files for logging in attempts. If the user enters the correct username and password, then he/she is taken to the index page. If the user enters the incorrect username or password, then the page would display "Incorrect username or password" and the number of attempts would decrement.
2. **Data-Input-Validation-Testing**

   Tests the PHP files that connect to database for data validation (CRN) in the our current database. If the test can find the section with the CRN, then it would print "OK". If the test finds the CRN even though it's not in the table, then these PHP files would fail the test.
3. **Conflict-Search-Testing**

   a. **Time-Conflict-Search**

   Tests the conflict searching PHP file for time-conflict findings. With the inputted CRN time data, if the PHP file successfully finds the time conflict with another CRN in the database, then this file passed.

   b. **Days-Conflict-Search**

   Tests the conflict searching PHP file for day-conflict findings. With the inputted CRN days, if the PHP file successfully finds the day conflict with another CRN in the database, then this file passed

   Note: If the PHP file finds a conflict even though there isn't one, then it failed both tests automatically. Also if the PHP can't find a conflict although there is one, then the file fails the test.
4. **Conflict-Calendar-Display-Testing**

   Tests if the conflict-storing PHP file displays all conflicts on the FullCalendar. It fails the test if not all conflicts are displayed.

D. System Testing

System testing will be done by as a result of other testing. For example part of the system testing includes black box testing so we will use the cucumber code for this. We will also work to implement a secondary server incase our main one fails. We can test that the system stays online when one of the servers goes down.

E. Acceptance Testing

Once the modules have been integrated and system testing is done, we will bring the project to an administrator, probably Karen or Dr. Reeves. They will then be given the chance to test out the system themselves and see if the functionality and aesthetics are up to his/her standards. In other words, do they like the appearance of the web based application and does it output the information they expected in a legible manner that would make utilization easy. If yes, we've done our job. If not, we take it back and add in whatever the admin felt was missing or change what they didn't like and then release product Zaboo 2.0 and do it all again. Ideally, this testing portion would be done the last week of November, no later than November 28th, giving us a week to make any changes post-testing before the final product is due.

F. Performance Testing

This portion of testing will most likely be done after the system integration, either during or immediately after User Acceptance Testing. If we're feeling like overachievers, we would test the performance of modules and then test them after they've been integrated. The more likely path however will be putting all of the pieces together and timing how long it takes for our application to output the calendar of conflicts. Ideally, the information would be displayed in 3- 5 seconds. That's about how long other web pages take to load and ours should be held to the same standard. If it takes longer than 10 seconds to load, it would safe to say that we need to rework our processes/function calls and maybe even re-analyze our database setup by going our ERD Diagram and DFD's. Theoretically, this would be done by November 30th, giving us time to try to make it more efficient but recognizing that a functional product that is a little slow is better than a late product, or even worse, a lack of one.

G. GOMS Testing

1. Keystroke Level Model

Tester: Our Team and one other user.

Press a key or button

Best typist = .08 seconds

Good typist = .12 seconds

Average skilled typist = .20 seconds

Average non-secretary = .28 seconds

Typing random letters = .50 seconds

Typing complex codes = .75 seconds

Worst typist = 1.2 seconds

Point with a mouse (excluding click) = 1.1 seconds

Move hands to keyboard from mouse (or vice-versa) = .4 seconds

Mentally prepare = 1.35 seconds

2. **Goals**

   a. Task: User types username and password and clicks login button

   - **Task groups:** User prepares his or herself,User moves, mouse types username and password

   b. Task: User types in crn and enters a time

   - **Task groups:** User prepares his or herself, User moves, mouse types username and password

H. Status Reports

Simply checking if weekly status reports were submitted with actual information on the progress of the project. For example, week 1, the front end was designed. Week 2 the back-end alpha is completed. Week 3, database created and tested. Week 4 was integration testing. Providing visual proof of the tests in the status reports would be bonus.

VI. GLOSSARY

Acceptance Testing - give the overall system to the user and see if it meets their expectations and/or desires

API - application programming interface; helps in building software applications

Black Box Testing - method of testing software without requiring the innards/specific code ie. cucumber

Course - is the class that a particular student is taking, but does not include the section

CRN - unique course number that also differentiates sections

Cucumber - behavior driven development; run acceptance tests to test the software

Data Flow Diagram(DFD) - graphical representation of how the data flows among the various pieces of the system

ERD Diagram - Entity-relationship diagram; describes the process within the database and the information within the database

Feature - a summary of what the system should be able to do and then follows are step by step descriptions of what should happen; first step in using cucumber

GOMS Test - Goals, Operators, Methods, and Selections; method of testing human interaction and usability

Incrementality - a principle of software engineering that encourages the development in pieces at a time

Integration Testing - begin combing modules and testing their connection

LAMP - acronym for a web stack made of 4 components; Linux operating system, Apache server, MySQL database, and PHP coding

Module Testing - testing chunks of the system's code

Performance Testing - test the system's speed and efficiency

Scenario - a situation to test when running cucumber as it's a potential outcome in the system

Schema - outline of database queries/table creation

Sections - student is enrolled in a section of a course which has a time and professor assigned to that section

Sequence Diagram - interaction diagram that demonstrates how processes interact with each other and the order those interactions occur

Status Reports - weekly reports on the team's progress in regards to the project completion

Step Definition - a step in utilizing cucumber written in Ruby; follows the feature and scenario declarations

System Testing - test the overall system, theoretically with all of the pieces

UML Diagram - Unified modeling diagram; visualization of the system's architecture

Use Case Diagram - representation of the interaction between the user and system

WAMP - same as LAMP, but for Windows instead of Linux

Zaboo 2.0 - name of Team 3's system/product revamped