

Lab 6 – Crawl, download, index, search and be awesome on all devices!

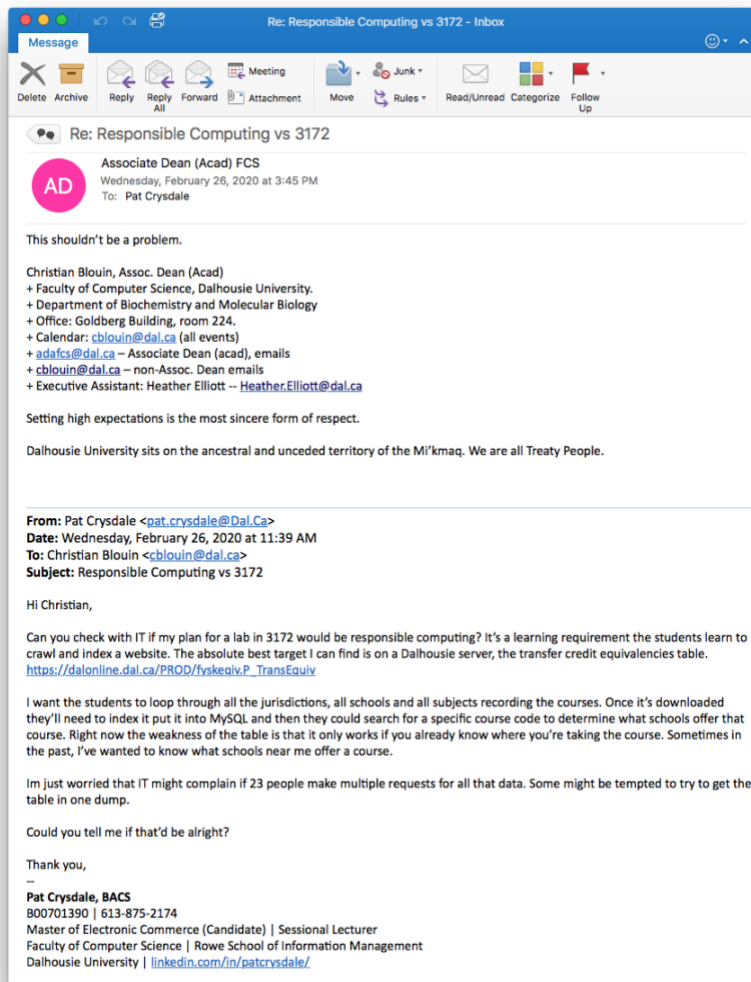
CSCI 3172 W20

Dalhousie University

Due: March 31th 11:59PM

This lab turned out to be huge and is worth 8% of your final grade.

In this lab, we will be crawling a Dalhousie webpage to get the contents of its database, and make it searchable. We have received special permission to crawl this specific resource from the Dean. It is always good practice to display such permission, so it is shown in the email below.



The only resource that we are permitted to crawl is:
https://dalonline.dal.ca/PROD/fyskequiv.P_TransEquiv

This resource is a database maintained by the registrar and contains previously approved transfer credits from other institutions. Shown below are Computer Science credits that transfer from Algonquin College.

Transfer Credit Equivalencies

This transfer credit equivalent information is for reference only. Course equivalents are subject to change upon official evaluation by the Registrar's Office. These equivalents are based on courses which have been previously assessed for transfer to Dalhousie. Missing courses does not necessarily indicate transfer credit will not be given. Since course content may change from year to year, and equivalence be withdrawn, students should be sure to contact individual departments to confirm status of any courses they intend to take at other universities.

A minimum grade of "C" or equivalent is required for "on admission" transfer credit to be awarded. Current Dalhousie/King's students who wish to take courses at other institutions must obtain approval in advance on a letter of permission form available online at www.registrar.dal.ca/forms. Please see regulation 7 in the undergraduate calendar.

Students that have attended Dalhousie Faculty of Agriculture can view course equivalencies by selecting Dal - Faculty of Agriculture. Appropriate grades, credit hours, time when the course was completed as well as the specific program in which a student is enrolled will determine whether or not the credit can be used towards another degree program.

Policy & Equivalency Information for Advanced Placement, International Baccalaureate, French Baccalaureate, and British System A-Level Classes

If you are a current post-secondary student in Nova Scotia, you may also find the MyTransferCreditGuide section of MyNSFuture useful.

If you don't know where the institution is located, select UNKNOWN for an alphabetical listing.

1. Select Province/State of Transfer Institution:

2. Select Institution:

3. Select Subject:

Algonquin College		Dalhousie Equivalent		Last Assessed
Class	Credit Hrs	Class	Credit Hrs	
DAT 5758A Computer Applications	45	CSCI 1200 Intro to Comput for Non-Majors	3	2017/2018 Summer
DAT 7110 Computer Applications	45	CSCI 1200 Intro to Comput for Non-Majors	3	2017/2018 Summer

Dal Online Main Menu (Login) Dalhousie Home Page

RELEASE: 5.4.D1
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The only way to search this database is to know the name of the school and the department. You cannot search by course code. This isn't very user friendly Your job is to build an app with this functionality.

Steps to complete this lab:

1. Crawl all subjects, at all institutions in all regions and download every table
2. Index the data and upload to your MySQL server
3. Create a webpage that has a search bar that can query your results by all headers. The website should be user friendly and responsive to desktop, tablet and mobile devices.

Do not worry. The basics of how to do all of the above are contained in the following pages. You will be provided with a significant shell to complete this lab.

We will start by crawling the database to download every subject table, from every school. Choose “Unknown” in the first drop-down menu. This will put every school in the database in the institution field.

The screenshot shows the Dalonline website interface. The top navigation bar includes the Dalhousie University logo and a search bar. The main content area is titled "Transfer Credit Equivalencies". A dropdown menu is open, displaying a list of universities, with "Acadia University" highlighted. The page contains several sections of text, including a disclaimer about the transfer credit information and a list of instructions for selecting a province/state, institution, and subject. The footer includes the release date (5.4.D1) and copyright information (© 2020 Ellucian Company L.P. and its affiliates).

Passing through Burp we can see that there is a post parameter called “prov” which has an option to be set to “ALLINST”.

The screenshot shows a Burp Suite HTTP history entry. The request is a POST to the URL `https://dalonline.dal.ca/PROD/fyskequiv.P_TransEquiv`. The request parameters are visible in the "Params" tab, showing `prov=ALLINST`. The request headers include `Host: dalonline.dal.ca`, `User-Agent: Mozilla/5.0 (X11; Linux x86_64; rv:68.0) Gecko/20100101 Firefox/68.0`, `Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8`, `Accept-Language: en-US,en;q=0.5`, `Accept-Encoding: gzip, deflate`, `Referer: https://dalonline.dal.ca/PROD/fyskequiv.P_TransEquiv`, `Content-Type: application/x-www-form-urlencoded`, `Content-Length: 12`, `Connection: close`, and `Upgrade-Insecure-Requests: 1`.

Choosing Acadia university (or any school) makes a subject field appear

1. Select Province/State of Transfer Institution:

2. Select Institution:

3. Select Subject:

```
POST /PROD/fyskequiv.P_TransEquiv HTTP/1.1
Host: dalonline.dal.ca
User-Agent: Mozilla/5.0 (X11; Linux x86_64; rv:68.0) Gecko/20100101 Firefox/68.0
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate
Referer: https://dalonline.dal.ca/PROD/fyskequiv.P_TransEquiv
Content-Type: application/x-www-form-urlencoded
Content-Length: 24
Connection: close
Upgrade-Insecure-Requests: 1
```

prov=ALLINST&inst=NSU002

We see now that there's another post parameter called inst that specifies the school. Finally, let's pick a subject... burp says the last parameter is called subj

1. Select Province/State of Transfer Institution:

2. Select Institution:

3. Select Subject:

Acadia University		Dalhousie Equivalent		Last Assessed
Class	Credit Hrs	Class	Credit Hrs	
COMP 1813 Computer Concepts and App	3	CSCI 1200 Intro to Comput for Non-Majors	3	2010/2011 Fall
COMP 1863 Computer Prog & General Appl	3	CSCI 1105 Intro to Computer Programming	3	2009/2010 Winter
COMP 1893 Multimedia Based Intro: Prog	3	CSCI 1200 Intro to Comput for Non-Majors	3	2009/2010 Winter
COMP 2203 Computer Architecture/Organiza	3	CSCI 2999 2000 level elective	3	2013/2014 Winter
COMP 2213 Comp. Architect/Organization 2	3	CSCI 2991 2000 Level Elective	3	2019/2020 Fall
COMP 2853 Handling Data Concepts/Apps	3	CSCI 2999 2000 Level Elective	3	2018/2019 Summer
COMP 2863 How Web Sites Work		CSCI 1170 Intro to Web Design & Devel.	3	2019/2020 Fall
COMP 3403 Analysis of Algorithms	3	CSCI 3110 Dsgn. & Anal. of Algorithms I.	3	2017/2018 Summer

```
POST /PROD/fyskequiv.P_TransEquiv HTTP/1.1
Host: dalonline.dal.ca
User-Agent: Mozilla/5.0 (X11; Linux x86_64; rv:68.0) Gecko/20100101 Firefox/68.0
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate
Referer: https://dalonline.dal.ca/PROD/fyskequiv.P_TransEquiv
Content-Type: application/x-www-form-urlencoded
Content-Length: 34
Connection: close
Upgrade-Insecure-Requests: 1
```

prov=ALLINST&inst=NSU002&subj=CSCI

We've now done enough information gathering to know that the table data is queried with: "prov, inst and subj". We now need values to give our crawler. These are stored in the dropdown menu, so we simply have to look at the source code. In Burp, look at under "Response" and then "HTML" for the HTTP packet you've intercepted.

Request	Response
Raw	Headers
Hex	HTML
Render	

```
<table CLASS="plaintable" >
<tr>
<td CLASS="pldefault">1. Select Province/State of Transfer Institution:</td>
<td CLASS="pldefault">
<select name="prov" size="1" onChange="provform.submit();">
<OPTION VALUE="DUMMY"></OPTION>
<OPTION VALUE="ALLINST" SELECTED>Unknown</OPTION>
<OPTION VALUE="NULL">Other/Out of Country</OPTION>
<OPTION VALUE="AL">Alabama</OPTION>
<OPTION VALUE="AK">Alaska</OPTION>
<OPTION VALUE="AB">Alberta</OPTION>
<OPTION VALUE="AZ">Arizona</OPTION>
<OPTION VALUE="AR">Arkansas</OPTION>
<OPTION VALUE="BC">British Columbia</OPTION>
<OPTION VALUE="CA">California</OPTION>
<OPTION VALUE="CO">Colorado</OPTION>
<OPTION VALUE="CT">Connecticut</OPTION>
<OPTION VALUE="DE">Delaware</OPTION>
<OPTION VALUE="DC">District of Columbia</OPTION>
<OPTION VALUE="FL">Florida</OPTION>
<OPTION VALUE="GA">Georgia</OPTION>
<OPTION VALUE="HI">Hawaii</OPTION>
<OPTION VALUE="ID">Idaho</OPTION>
<OPTION VALUE="IL">Illinois</OPTION>
<OPTION VALUE="IN">Indiana</OPTION>
<OPTION VALUE="IA">Iowa</OPTION>
<OPTION VALUE="KS">Kansas</OPTION>
<OPTION VALUE="KY">Kentucky</OPTION>
<OPTION VALUE="LA">Louisiana</OPTION>
<OPTION VALUE="ME">Maine</OPTION>
<OPTION VALUE="MB">Manitoba</OPTION>
<OPTION VALUE="MD">Maryland</OPTION>
<OPTION VALUE="MA">Massachusetts</OPTION>
<OPTION VALUE="MI">Michigan</OPTION>
<OPTION VALUE="MN">Minnesota</OPTION>
<OPTION VALUE="MS">Mississippi</OPTION>
<OPTION VALUE="MO">Missouri</OPTION>
<OPTION VALUE="MT">Montana</OPTION>
<OPTION VALUE="NE">Nebraska</OPTION>
<OPTION VALUE="NV">Nevada</OPTION>
<OPTION VALUE="NB">New Brunswick</OPTION>
```

```
<td CLASS="pldefault">3. Select Subject:</td>
<td CLASS="pldefault">
<select name="subj" size="1" onChange="subjform.submit();">
<OPTION VALUE="DUMMY"></OPTION>
<OPTION VALUE="AGRI">Agriculture-Agricultural Camp</OPTION>
<OPTION VALUE="ANAT">Anatomy</OPTION>
<OPTION VALUE="APSC">Applied Science-Agri Campus</OPTION>
<OPTION VALUE="ARTH">Art History</OPTION>
<OPTION VALUE="ASSC">Arts & Social Sciences</OPTION>
<OPTION VALUE="BIOC">Biochem & Molecular Biology</OPTION>
<OPTION VALUE="BIOL">Biology</OPTION>
<OPTION VALUE="BIOA">Biology-Agricultural Campus</OPTION>
<OPTION VALUE="BUSI">Business Admin</OPTION>
<OPTION VALUE="CANA">Canadian Studies</OPTION>
<OPTION VALUE="CHEE">Chemical Engineering</OPTION>
<OPTION VALUE="CHEM">Chemistry</OPTION>
<OPTION VALUE="CHMA">Chemistry-Agricultural Campus</OPTION>
<OPTION VALUE="CLAS">Classics</OPTION>
<OPTION VALUE="COMM">Commerce</OPTION>
<OPTION VALUE="CMMT">Communications-Agri Campus</OPTION>
<OPTION VALUE="COMR">Comparative Religion</OPTION>
<OPTION VALUE="CPST">Complementary Studies</OPTION>
<OPTION VALUE="CSCA">Computer Sci-Agricultural Camp</OPTION>
<OPTION VALUE="CSCI" SELECTED>Computer Science</OPTION>
<OPTION VALUE="ERTH">Earth Sciences</OPTION>
<OPTION VALUE="ECON">Economics</OPTION>
<OPTION VALUE="ECON">Economics-Agricultural Campus</OPTION>
<OPTION VALUE="ECED">Electrical & Computer Engineer</OPTION>
<OPTION VALUE="ENGI">Engineering</OPTION>
<OPTION VALUE="ENVS">Engineering Mathematics</OPTION>
<OPTION VALUE="ENGN">Engineering-Agri Campus</OPTION>
<OPTION VALUE="ENGL">English</OPTION>
<OPTION VALUE="EGLA">English-Agricultural Campus</OPTION>
<OPTION VALUE="ENVS">Environmental Science</OPTION>
<OPTION VALUE="ENVI">Environmental Studies</OPTION>
<OPTION VALUE="FOSC">Food Science</OPTION>
<OPTION VALUE="FREN">French</OPTION>
<OPTION VALUE="FRNA">French-Agricultural Campus</OPTION>
<OPTION VALUE="GWST">Gender & Women's Studies</OPTION>
```

Request	Response
Raw	Headers
Hex	HTML
Render	

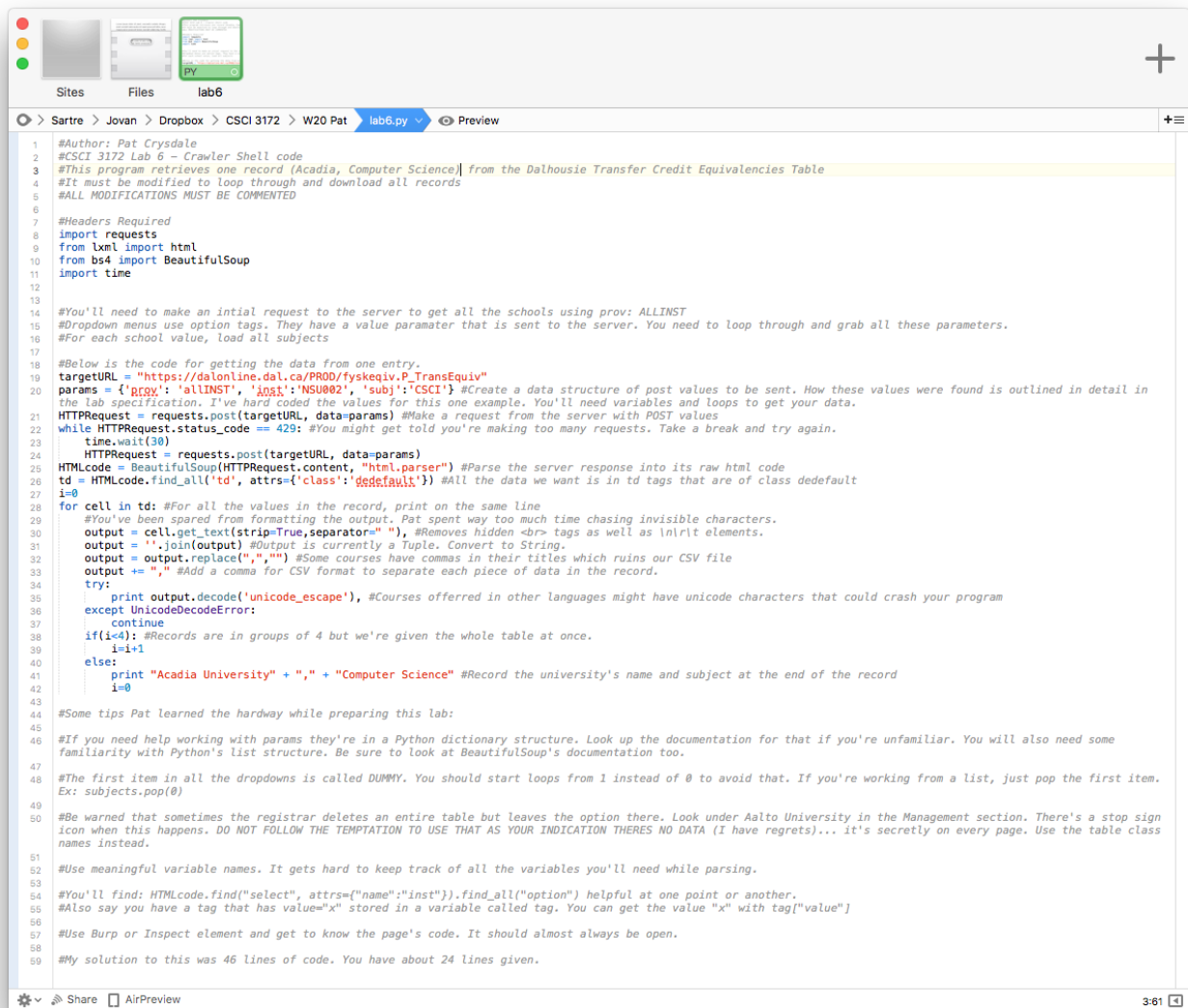
```
<td CLASS="pldefault">2. Select Institution:</td>
<td CLASS="pldefault">
<select name="inst" size="1" onChange="instform.submit();">
<OPTION VALUE="DUMMY"></OPTION>
<OPTION VALUE="XPL015">AGH Univ of Sci & Tech</OPTION>
<OPTION VALUE="XCN491">AHJZU Anhui Jianzhu University</OPTION>
<OPTION VALUE="XFI014">Aalto University</OPTION>
<OPTION VALUE="XOK007">Aarhus School of Business</OPTION>
<OPTION VALUE="XGB002">Aberdeen Univ</OPTION>
<OPTION VALUE="XRB001">Abu Centro Uni Rio De Janeiro</OPTION>
<OPTION VALUE="XNG025">Abia State University</OPTION>
<OPTION VALUE="XAE009">Abu Dhabi University</OPTION>
<OPTION VALUE="XHN002">Acad de dspanol Guacanaya</OPTION>
<OPTION VALUE="CAUL16">Academy of Art University</OPTION>
<OPTION VALUE="XRO005">Academy of Econ Sciences</OPTION>
<OPTION VALUE="NSU002" SELECTED>Acadia University</OPTION>
<OPTION VALUE="XPL018">Adam Mickiewicz University</OPTION>
<OPTION VALUE="XPK055">Adamjee Govt Science Colleges</OPTION>
<OPTION VALUE="XET001">Addis Ababa University</OPTION>
<OPTION VALUE="NYU094">Adirondack Coll College</OPTION>
<OPTION VALUE="MIU056">Adrian Colleges</OPTION>
<OPTION VALUE="XNG131">Afe Babalola University</OPTION>
<OPTION VALUE="XBD0016">Ahsanullah Univ of Sci & Tech</OPTION>
<OPTION VALUE="XIRL12">Ahvaz Jundishapur Uni Med Sci</OPTION>
<OPTION VALUE="XEG001">Ain Shams University</OPTION>
<OPTION VALUE="XAE007">Ajman Univ of Sci & Tech</OPTION>
<OPTION VALUE="XSA064">Al Baha University</OPTION>
<OPTION VALUE="XKZ002">Al Farabi Kazakh National Univ</OPTION>
<OPTION VALUE="XSD004">Al Neelain University</OPTION>
<OPTION VALUE="XJ0012">Al-Ahliyya Amman University</OPTION>
<OPTION VALUE="XJ0017">Al-Balqa Applied University</OPTION>
<OPTION VALUE="XNZ001">Al-Mustansiriyah University</OPTION>
<OPTION VALUE="ALU001">Alabama A & M University</OPTION>
<OPTION VALUE="XMA003">Alakhawayn University</OPTION>
<OPTION VALUE="NYU117">Albany College of Pharmacy</OPTION>
<OPTION VALUE="XDE001">Albert Ludwigs Univ</OPTION>
<OPTION VALUE="ABU037">Alberta Coll of Art & Design</OPTION>
<OPTION VALUE="BCU094">Alexander College</OPTION>
<OPTION VALUE="XEG006">Alexandria Univ</OPTION>
<OPTION VALUE="ONU001">Algoma Colleges</OPTION>
<OPTION VALUE="ONU210">Algoma University</OPTION>
```

You will notice that all that data is there but is too much for a human. This is most definitely a job for a crawler.

In class, I showed how to use Python's BeautifulSoup and Scapy libraries to crawl and gather information from sites. You will need one of those libraries to complete this lab.

I've provided a starting point on Brightspace called lab6.py. My program is thoroughly commented. This should be enough of an introduction that with some tinkering you should be able to complete it.

Here is a screen capture of that code.



```
1 #Author: Pat Crysdale
2 #CSCI 3172 Lab 6 - Crawler Shell code
3 #This program retrieves one record (Acadia, Computer Science] from the Dalhousie Transfer Credit Equivalencies Table
4 #It must be modified to loop through and download all records
5 #ALL MODIFICATIONS MUST BE COMMENTED
6
7 #Headers Required
8 import requests
9 from lxml import html
10 from bs4 import BeautifulSoup
11 import time
12
13
14 #You'll need to make an initial request to the server to get all the schools using prov: ALLINST
15 #Dropdown menus use option tags. They have a value parameter that is sent to the server. You need to loop through and grab all these parameters.
16 #For each school value, load all subjects
17
18 #Below is the code for getting the data from one entry.
19 targetURL = "https://dalonline.dal.ca/PROD/fyskequiv.P_TransEquiv"
20 params = {'prov': 'allINST', 'inst': 'NSU002', 'subj': 'CSCI'} #Create a data structure of post values to be sent. How these values were found is outlined in detail in
21 the lab specification. I've hard coded the values for this one example. You'll need variables and loops to get your data.
22 HTTPRequest = requests.post(targetURL, data=params) #Make a request from the server with POST values
23 while HTTPRequest.status_code == 429: #You might get told you're making too many requests. Take a break and try again.
24     time.sleep(30)
25 HTTPRequest = requests.post(targetURL, data=params)
26 HTMLcode = BeautifulSoup(HTTPRequest.content, "html.parser") #Parse the server response into its raw html code
27 td = HTMLcode.find_all('td', attrs={'class': 'default'}) #All the data we want is in td tags that are of class default
28 i=0
29 for cell in td: #For all the values in the record, print on the same line
30     output = cell.get_text(strip=True, separator=" ") #Removes hidden <br> tags as well as \n\r\t elements.
31     output = ''.join(output) #Output is currently a Tuple. Convert to String.
32     output = output.replace(",","") #Some courses have commas in their titles which ruins our CSV file
33     output += "," #Add a comma for CSV format to separate each piece of data in the record.
34     try:
35         print output.decode('unicode_escape') #Courses offered in other languages might have unicode characters that could crash your program
36     except UnicodeDecodeError:
37         continue
38     if(i%4): #Records are in groups of 4 but we're given the whole table at once.
39         i=i+1
40     else:
41         print "Acadia University" + "," + "Computer Science" #Record the university's name and subject at the end of the record
42         i=0
43
44 #Some tips Pat learned the hardway while preparing this lab:
45
46 #If you need help working with params they're in a Python dictionary structure. Look up the documentation for that if you're unfamiliar. You will also need some
47 familiarity with Python's list structure. Be sure to look at BeautifulSoup's documentation too.
48 #The first item in all the dropdowns is called DUMMY. You should start loops from 1 instead of 0 to avoid that. If you're working from a list, just pop the first item.
49 Ex: subjects.pop(0)
50
51 #Be warned that sometimes the registrar deletes an entire table but leaves the option there. Look under Aalto University in the Management section. There's a stop sign
52 icon when this happens. DO NOT FOLLOW THE TEMPTATION TO USE THAT AS YOUR INDICATION THERE'S NO DATA (I have regrets)... it's secretly on every page. Use the table class
53 names instead.
54
55 #Use meaningful variable names. It gets hard to keep track of all the variables you'll need while parsing.
56
57 #You'll find: HTMLcode.find("select", attrs={"name": "inst"}).find_all("option") helpful at one point or another.
58 #Also say you have a tag that has value="x" stored in a variable called tag. You can get the value "x" with tag["value"]
59
60 #Use Burp or Inspect element and get to know the page's code. It should almost always be open.
61
62 #My solution to this was 46 lines of code. You have about 24 lines given.
```


Its output looks like this...

```
Sartre:W20 Pat patcrysdale$ python lab6.py
COMP 1813 Computer Concepts and App, 3, CSCI 1200 Intro to Comput for Non-Majors, 3, 2010/2011 Fall, Acadia University,CSCI
COMP 1863 Computer Prog & General Appl, 3, CSCI 1105 Intro to Computer Programming, 3, 2009/2010 Winter, Acadia University,CSCI
COMP 1893 Multimedia Based Intro: Prog, 3, CSCI 1200 Intro to Comput for Non-Majors, 3, 2009/2010 Winter, Acadia University,CSCI
COMP 2203 Computer Architecture/Organiza, 3, CSCI 2999 2000 level elective, 3, 2013/2014 Winter, Acadia University,CSCI
COMP 2213 Comp. Architect/Organization 2, 3, CSCI 2991 2000 Level Elective, 3, 2019/2020 Fall, Acadia University,CSCI
COMP 2853 Handling Data Concepts/Apps, 3, CSCI 2999 2000 Level Elective, 3, 2018/2019 Summer, Acadia University,CSCI
COMP 2863 How Web Sites Work, , CSCI 1170 Intro to Web Design & Devel., 3, 2019/2020 Fall, Acadia University,CSCI
COMP 3403 Analysis of Algorithms, 3, CSCI 3110 Dsgn. & Anal. of Algorithms I., 3, 2017/2018 Summer, Acadia University,CSCI
Sartre:W20 Pat patcrysdale$
```

You have just extracted all of the data from this table. See?

1. Select Province/State of Transfer Institution:
2. Select Institution:
3. Select Subject:

Acadia University		Dalhousie Equivalent		Last Assessed
Class	Credit Hrs	Class	Credit Hrs	
COMP 1813 Computer Concepts and App	3	CSCI 1200 Intro to Comput for Non-Majors	3	2010/2011 Fall
COMP 1863 Computer Prog & General Appl	3	CSCI 1105 Intro to Computer Programming	3	2009/2010 Winter
COMP 1893 Multimedia Based Intro: Prog	3	CSCI 1200 Intro to Comput for Non-Majors	3	2009/2010 Winter
COMP 2203 Computer Architecture/Organiza	3	CSCI 2999 2000 level elective	3	2013/2014 Winter
COMP 2213 Comp. Architect/Organization 2	3	CSCI 2991 2000 Level Elective	3	2019/2020 Fall
COMP 2853 Handling Data Concepts/Apps	3	CSCI 2999 2000 Level Elective	3	2018/2019 Summer
COMP 2863 How Web Sites Work		CSCI 1170 Intro to Web Design & Devel.	3	2019/2020 Fall
COMP 3403 Analysis of Algorithms	3	CSCI 3110 Dsgn. & Anal. of Algorithms I.	3	2017/2018 Summer

Write the output of your code to a .csv file. In your terminal write “python [filename].py > [someoutputfile].csv”.

```
Sartre:W20 Pat patcrysdale$ python lab6.py > output.csv
Sartre:W20 Pat patcrysdale$
```

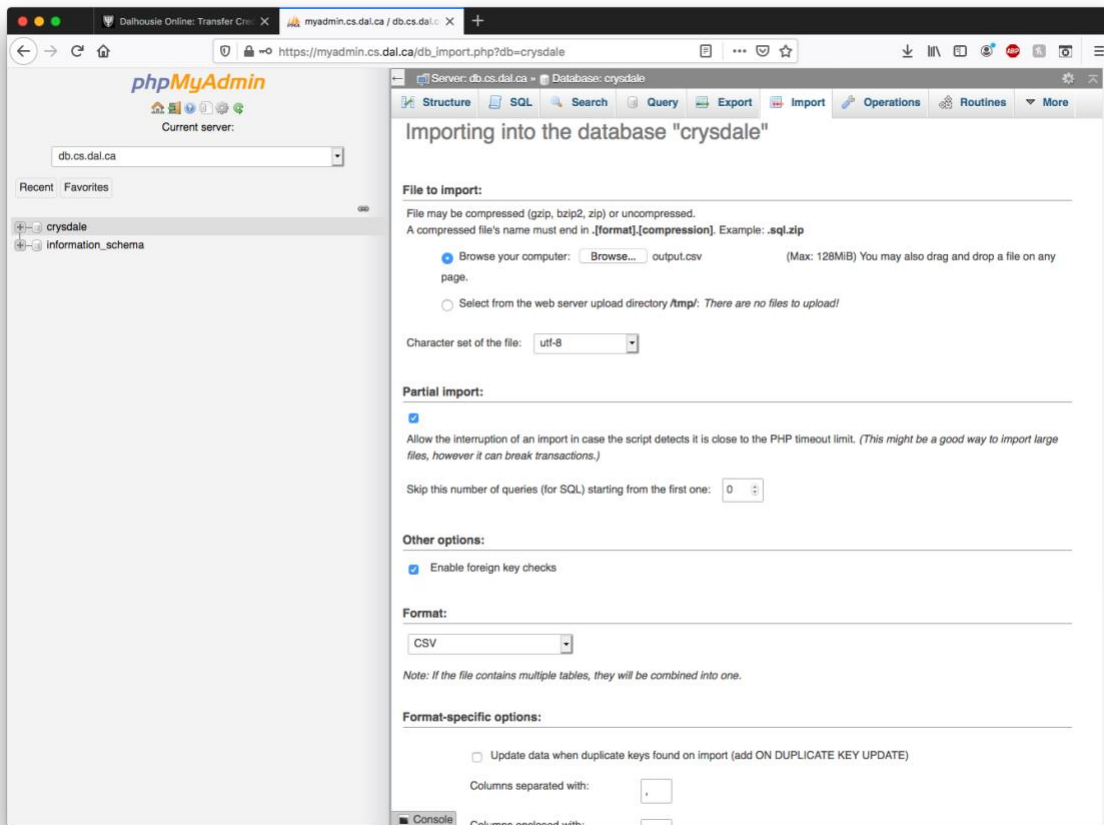
	A	B	C	D	E	F	G
1	COMP 1813 Computer Concepts and App	3	CSCI 1200 Intro to Comput for Non-Majo	3	2010/2011 Fall	Acadia University	CSCI
2	COMP 1863 Computer Prog & General Appl	3	CSCI 1105 Intro to Computer Programm	3	2009/2010 Winter	Acadia University	CSCI
3	COMP 1893 Multimedia Based Intro: Prog	3	CSCI 1200 Intro to Comput for Non-Majo	3	2009/2010 Winter	Acadia University	CSCI
4	COMP 2203 Computer Architecture/Organiza	3	CSCI 2999 2000 level elective	3	2013/2014 Winter	Acadia University	CSCI
5	COMP 2213 Comp. Architect/Organization 2	3	CSCI 2991 2000 Level Elective	3	2019/2020 Fall	Acadia University	CSCI
6	COMP 2853 Handling Data Concepts/Apps	3	CSCI 2999 2000 Level Elective	3	2018/2019 Summer	Acadia University	CSCI
7	COMP 2863 How Web Sites Work		CSCI 1170 Intro to Web Design & Devel.	3	2019/2020 Fall	Acadia University	CSCI
8	COMP 3403 Analysis of Algorithms	3	CSCI 3110 Dsgn. & Anal. of Algorithms I.	3	2017/2018 Summer	Acadia University	CSCI
9							
10							

Here is a sample of what your dataset should look like once you've crawled the entire table.

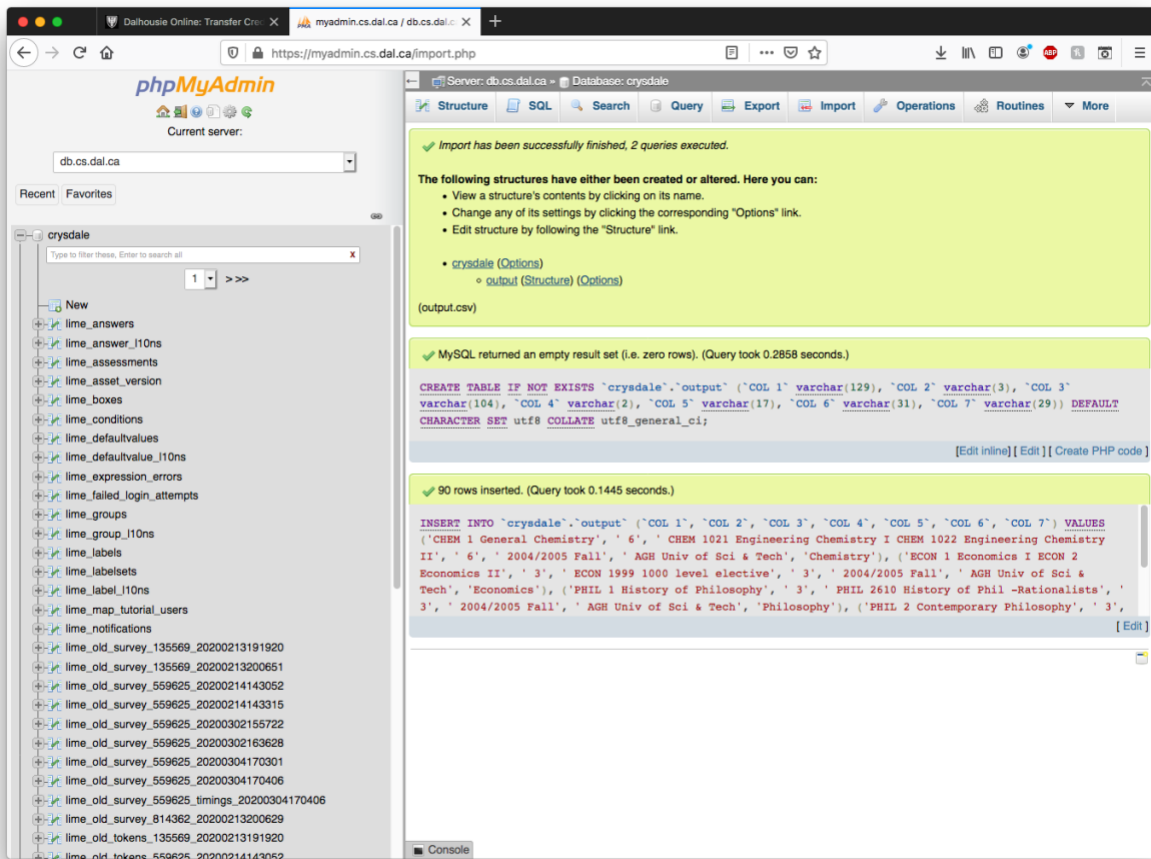
	A	B	C	D	E	F	G	H
1	CHEM 1 General Chemistry	6	CHEM 1021 Engineering Chemistry I CHEM	6	2004/2005 Fall	AGH Univ of Sci & Tech	Chemistry	
2	ECON 1 Economics I ECON 2 Economics II	3	ECON 1999 1000 level elective	3	2004/2005 Fall	AGH Univ of Sci & Tech	Economics	
3	PHIL 1 History of Philosophy	3	PHIL 2610 History of Phil -Rationalists	3	2004/2005 Fall	AGH Univ of Sci & Tech	Philosophy	
4	PHIL 2 Contemporary Philosophy	3	PHIL 3640 20th Century Philosophy	3	2004/2005 Fall	AGH Univ of Sci & Tech	Philosophy	
5	PHYC 1 Physics	6	PHYC 1100 Introduct Physics	6	2004/2005 Fall	AGH Univ of Sci & Tech	Physics & Atmospheric Scie	
6	CHEM IOC Inorganic Chemistry CHEM WAC Water Analytical Chem.	4	CHEM 2999 2000 Level Elective	3	2017/2018 Winter	AHZU Anhui Jianzhu University	Chemistry	
7	MATH AM2 Advanced Mathematics II MATH LAB Linear Algebra B	6	MATH 1000 Differential & Integral Calc I	3	2017/2018 Winter	AHZU Anhui Jianzhu University	Mathematics	
8	MU26C 600 Entrep. in the Gbl. Eco.	6	COMM 2999 2000 Level Elective	3	2016/2017 Fall	Aalto University	Commerce	
9	MU26C 600 Intl. Sales Mgmt	6	COMM 3999 3000 Level Elective	3	2016/2017 Fall	Aalto University	Commerce	
10	MU26C 679 Intercultural Negotiations	6	COMM 2999 2000 Level Elective	3	2016/2017 Fall	Aalto University	Commerce	
11	MU26C 680 Mgmt. Info. Sys. in Int. Busi.	6	COMM 2999 2000 Level Elective	3	2016/2017 Fall	Aalto University	Commerce	
12	MU26C 698 Destination Marketing	6	COMM 2999 2000 Level Elective	3	2016/2017 Fall	Aalto University	Commerce	
13	MU26C 714 Gdr. & Comm in the Intl Wrkplc	6	COMM 3999 3000 Level Elective	3	2016/2017 Fall	Aalto University	Commerce	
14	IFHP 1 New Nodes of Urbanity	3	PLAN 3999 3000 Level Elective	3	2016/2017 Winter	Aalto University	Planning	
15	MAA 78.3350 21st Century Urban Block	3	PLAN 5050 Topics in Community Design.	3	2013/2014 Fall	Aalto University	Planning	
16	YTX 1 Urban Plan/Design Summer schoo	3	PLAN 3999C 3000-Level Elective	3	2009/2010 Summer	Aalto University	Planning	
17	ECON 4621010 060 Trade and International Econ	3	ECON 2999 2000 Level Elective	3	2012/2013 Winter	Aarhus School of Business	Economics	
18	BI 1004 Organismal Biology BI 1505 The Cell	6	BIOL 1010 Principles of Biology I BIOL 1011 I	9	2005/2006 Summer	Aberdeen Univ	Biology	
19	CM 1011 Essentials of Chemistry	3	CHEM 1011 General Chemistry I	3	2005/2006 Winter	Aberdeen Univ	Chemistry	
20	CM 1506 Chemistry 1b: Appl in Real Wild	3	CHEM 1012 General Chemistry II	3	2005/2006 Summer	Aberdeen Univ	Chemistry	
21	EC 1003 Microeconomics I	3	ECON 1101 Principles of Microeconomics	3	2004/2005 Summer	Aberdeen Univ	Economics	
22	MA 1004 Introductory Mathematics 1 MA 1504 Introductory Mathematics 2	6	MATH 1000 Differential & Integral Calc	3	2005/2006 Fall	Aberdeen Univ	Mathematics	
23	PX 2011 An Intro to Space Science &	3	PHYC 2999 2000 Level Elective	3	2005/2006 Summer	Aberdeen Univ	Physics & Atmospheric Scie	
24	TRC 102 Techniques of Struct. Programm	3	CSCI 1100 Computer Science I	3	2011/2012 Summer	Abeu Centro Uni Rio De Janeiro	Computer Science	
25	TRC 202 Structure of Data	3	CSCI 2132 Software Development	3	2011/2012 Summer	Abeu Centro Uni Rio De Janeiro	Computer Science	
26	TRC 205 Digital Systems	3	CSCI 2121 Intro-Comp Org/Assembly Lang	3	2011/2012 Summer	Abeu Centro Uni Rio De Janeiro	Computer Science	
27	TRC 301 Principles of Operating	3	CSCI 3120 Operating Systems	3	2011/2012 Summer	Abeu Centro Uni Rio De Janeiro	Computer Science	
28	TRC 304 Data Communication TRC 305 Topologies of Comp. Networks TRC 401	12	CSCI 4999 4000 Level Elective	3	2011/2012 Summer	Abeu Centro Uni Rio De Janeiro	Computer Science	
29	TRC 404 Networks Operating Systems	3	CSCI 3999 3000 Level Elective	3	2011/2012 Summer	Abeu Centro Uni Rio De Janeiro	Computer Science	
30	TRC 406 Arch. of Hardward Processes	3	CSCI 3121 Comp. Systems Architecture	3	2011/2012 Summer	Abeu Centro Uni Rio De Janeiro	Computer Science	
31	TRC 501 Admin. & Mgmt of Networks	3	CSCI 3999 3000 Level Elective	3	2011/2012 Summer	Abeu Centro Uni Rio De Janeiro	Computer Science	
32	TRC 502 Databases	3	CSCI 3140 Database Management Systems	3	2011/2012 Summer	Abeu Centro Uni Rio De Janeiro	Computer Science	
33	TRC 503 Parallel Architectures	3	CSCI 4999 4000 Level Elective	3	2011/2012 Summer	Abeu Centro Uni Rio De Janeiro	Computer Science	
34	TRC 505 Const. of Intranet & Extranet	3	CSCI 3171 Network Computing	3	2011/2012 Summer	Abeu Centro Uni Rio De Janeiro	Computer Science	
35	TRC 602 Distributed Programming	3	CSCI 3999 3000 Level Elective	3	2011/2012 Summer	Abeu Centro Uni Rio De Janeiro	Computer Science	

Part 2:

You now have your data. If it's a CSV file it can be uploaded to your MySQL database.



You're now ready to index your database. Do some research and find choose an indexing method that works for your needs.



PS You're going to have more than 90 rows.

Part 3:

Grab your favorite front end framework and make a basic search page. Its wireframe should be similar to Google's. **Your search page must be responsive and adapt to desktop, tablet and mobile interfaces.**

Connect the search bar to your MySQL database.

Your search bar should be able to search and retrieve based on any combination of the following criteria:

- Host university
- Course name/code at host
- Course name/code at Dalhousie – (e.g. All equivalents to CSCI 3172)
- Credit hours
- Approval date

Output the results of your search.

Section	Not Submitted (0%)	Approaching Expectations (<80%)	Meeting Expectations (=80%)	Exceeds Expectations (>80%)
Crawler			<p>All pages scraped</p> <p>CSV output is cleanly formatted</p> <p>Modifications to code have reasonable comments.</p>	
MySQL database / Retrieved dataset			<p>Data is indexed.</p> <p>Why you chose your indexing strategy is justified</p> <p>Entire dataset present.</p>	
Search			<p>Is responsive to mobile, tablet and desktop interfaces</p> <p>Searches entire dataset effectively. (TAs will be given random records to test).</p> <p>Search results are displayed in a usable format</p> <p>Search options are implemented (Can search for combination of terms)</p>	