COMP474-6741 Project Assignment #1

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1 Competency Questions Part I

The competency questions focused on how the agent would be able to assess relations between the student class and the university class as well as testing various types of SPARQL queries. Including the first 3 that were mentioned in the handout, they are as follows:

1. What is course [SUBJECT][COURSE NUMBER], that is offered by [UNIVERSITY], about?

2. Which topics is [STUDENT FIRST NAME] [STUDENT LAST NAME] competent in?

3. Which subjects at [UNIVERSITY] teach [TOPIC]?

4. What are all the courses with a [SUBJECT] subject at [UNIVERSITY]?

5. How many students are enrolled in each course that is offered by [UNIVERSITY]?

6. What courses are worth [CREDITS] credits at [UNIVERSITY]?

7. What are the topics of [SUBJECT][COURSE NUMBER] at [UNIVERSITY]?

8. Which students have retaken the same course at least [COUNT]?

9. Which students failed [SUBJECT][COURSE NUMBER] at [UNIVERSITY]?

10. What are the [REQUIREMENT STATUS] readings' [TITLE] and [URL] in [SUBJECT] [COURSE NUMBER] offered by [UNIVERSITY] in lecture [NUMBER]?

2 Vocabulary

The vocabulary and schema of the knowledge base were modeled by following standard W3C technologies: RDF and RDFS, by utilizing existing vocabularies [1]: Dublin Core, DBpedia, foaf, owl, vcard, wikidata, xsd, and vivo and were extended using developed classes and properties [1][2][3][4][5][6][7][8][9][10]. Table 1 highlights the classes and properties used to model the information [2]. Existing vocabularies where utilized in the modeling of the schema for properties and classes wherever possible as they're well maintained, updated regularly, commonly used, and link the data to existing knowledge graphs.

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[1]For more details regarding classes and properties used from existing vocabularies refer to figure 1 in the appendix.

[2]For more details regarding developed classes and properties refer to the schema.

Information	Class/Property
Universities	vivo:University
University name	rdfs:label
Link	owl:sameAs
Courses	vivo:Course
Course name	vivo:Title
Course subject	vivo:hasSubjectAre
Course number	vivo:identification
Course credits	vivo:CourseCredits
Course description	vivo:description
Course outline	focu:outline
Lectures	focu:lecture
Lecture number	bibo:number
Lecture name	vivo:Title
Lecture content	vivo:contains
Slides	focu:slide
Worksheets	focu:worksheet
Outline	focu:outline
Readings	focu:readings
Other material	focu:otherMaterial
Topics	focu:topic
Provenance information	focu:source
Students	focu:vivoStudent
Student name(first, last)	foaf:givenName, foaf:familyName
Student ID number	vivo:identification
Student email	foaf:mbox
Student completed courses	focu:completedCourse
Student competencies	focu:hasExpertise

Table 1: Information and Vocabulary

3 Knowledge Base Construction and Population

The data for courses was taken from Concordia open data website [11] and the data for universities was taken from DBpedia. As for other files (e.g., outline, slides, worksheets, ... of previous courses) local copies attained from course website and Moodle were used. To populate the knowledge base, for each information class: universities, courses, lectures, topics, and students a getRDF script was developed to generate related triples. The getRDF script for universities, courses, lectures, and students generates the triples automatically. To generate topics triples, course material (slides, worksheets, labs, and outline) were converted to plain text using pdfplumber library [12]. Next, DBpedia Spotlight is run over the converted documents for entity linking from which a list of entities and their DBpedia URI is extracted [13]. Lastly the aforementioned list is passed through a spaCy filter to extract named entities [14]. The filter is designed to select entities with specific POS tags obtained from spaCy glossary [15].

4 Knowledge Base Statistics

In addition, we provided queries and their output for statistics about our knowledge base, including the total number of triples, the total number of courseURIs, the number of distinct topics, and the number of topic/course instances:

triples	courseURIs	distinct_topics	topic_instances
309241	7154	329	817

5 Queries

For translating the competency questions into queries, the values that are surrounded by square braces are given values for the queries. These would be used as starting points for the queries, eventually these will be part of the user's input which will change depending on the request without having to rewrite the entire query. As for the return values, these depended on what the question was. In general, the question was analyzed to see which class would contain the desired values then using the input values to form a series of triples that would link to them. Example outputs of the queries are as follows, note that for some of the queries only a small sample of their output is shown and due to the random generated nature of the knowledge base, the outputs shown are for a certain instance of the knowledge base

5.1 Part I

NB— Implemented in Chatbot (✓)

courseName	courseNumber	title	courseDesc
COMP	474	Intelligent Systems	Rule-based exp...

Part I: Query 1: What is COMP 474, that is offered by Concordia University, about?

expertise
Heidelberg
Stuart Russell
Diffbot
...

Part I: Query 2: Which topics is Trenae Bryan competent in?

courseName	subjectArea	courseNum	frequency
Intelligent Systems	RELI	474	48
INTRO TO A.I.	SOCI	6721	4

Part I: Query 3: Which subjects at Concordia University teach DBpedia?

course	subjectCode	courseNum
SELECTED TOPICS IN SOFTWARE	COMP	749
Techniques in Symbolic Computation	COMP	367
Design and Analysis of Algorithms	COMP	465
...	...	...

Part I: Query 4: What are all the courses with a COMP subject at Concordia University?

subject	catalog	count
ACCO	220	5
ACCO	230	4
ACCO	240	6
ACCO	310	4
...	...	...

Part I: Query 5: How many students are enrolled in each course that is offered by Concordia University?

title	subjectCode	courseNum	credit
NONLINEAR SYSTEMS	ENGR	6141	4.0
TUTORIAL IN INF SYS/...	ACCO	603	4.0
CAPSTONE AEROSPACE ...	AERO	490	4.0
...	...	...	...

Part I: Query 6: What courses are worth 4.0 credits at Concordia University?

expertise
Heidelberg
Stuart Russell
Diffbot
...

Part I: Query 7: What are the topics of COMP 474 at Concordia University?

subjectArea	catalog	firstName	lastName	studentID	nbTimesTaken
AHSC	330	Breia	Crowell	43248687	2
ANTH	270	Sanya	Ray	41103045	2
ANTH	345	Sinead	Thomas	47855211	2
...	...	...	...	...	...

Part I: Query 8: Which students have retaken the same course at least 2 times?

firstName	lastName	studentID	courseName	courseNumber	grade
Mariela	Morrow	43952942	SOCI	336	F

Part I: Query 9: Which students have failed SOCI 336 at Concordia University?

reqLabel	title	website
required	[Yu14,Chapters1,2]...	https://concordia...
supplemental	[Wor14](RDFPrimer)...	http://www.w3.org...
supplemental	[RN10,Chapter12]...	https://concordia...
supplemental	Graphdatabases...	https://www.youtube.

Part I: Query 10: What are the readings for COMP 474 offered by Concordia University in lecture 2?

5.2 Part II

5.2.1 Knowledge Base Population

NB— Not Implemented in Chatbot (✗)

subject	catalog	topicLabel	dbpediaURI	eventURI	resourceURI
COMP	474	Heidelberg	...Heidelberg	...	...
COMP	474	... Russell	..._Russell	...	...
...	...	...	...	...	...
COMP	6721	Centroid	.../Centroid	...	...
...	...	...	...	...	...

Part II: Query 1: For a course c, list all covered topics t, printing out their English labels and their DBpedia URI, together with the course event URI (e.g., 'lab3') and resource URI (e.g., 'slides10') where they appeared.

dbpediaURI	topicLabel	catalog	subject	topicCount
.../Concordia_University	Concordia	474	COMP	75
.../DBpedia	DBpedia	474	COMP	36
.../English_language	English language	474	COMP	24
...	...	...	...	...
.../Artificial_intelligence	AI	6721	COMP	18
.../Natural_language_processing	Natural Language ...	474	COMP	15
...	...	...	...	...

Part II: Query 2: For a given topic t (DBpedia URI), list all courses where they appear, together with a count, sorted by frequency

topicLabel	courseURI	eventURI	resourceURI
Data Publishing	...#courseID_005484	.../data#005484_Lecture05	.../slides05.pdf
Weak AI	...#courseID_040353	.../data#040353_Lecture01	.../slides01.pdf
...	...	...	...

Part II: Query 3: For a given topic t, list the precise course URI, course event URI and corresponding resource URI where the topic is covered (e.g., "NLP" is covered in COMP474 → Lecture 10 → Lab 10 → Lab Notes)

5.2.2 University Chatbot

NB— Implemented in Chatbot (✓)

Some of the queries coincide with existing queries in part I:

1. see queries 1-10 in part I

2. "What is the [course] about?" : see query 1 in part I

3. "Which topics are covered in [course event]?" : See below

topicLabel	resourceURI
XOR	/worksheet05.pdf
neuron	/worksheet05.pdf
Perceptron	/worksheet05.pdf
Delta	/worksheet05.pdf
Alison	/worksheet05.pdf

Part II: Query 4: Which topics are covered in worksheet 5 of COMP 6721?

4. "Which courses cover [Topic]?" : see query 3 in part I

6 Rasa Chatbot

For designing the chatbot, we used the competency questions that were associated with each query. That way, we can see where the chatbot should extract the variables. This is represented by the words surrounded by square brackets as seen in Section 1.The variables would be extracted using Rasa's entity system to pull the text from input and classify them. Once the variables are extracted and stored in the chatbot's memory, which is done using the slots, it would place those into the appropriate query. We provided structure of the queries to the bot in its custom action classes and it just needs to substitute the variables. Afterwards, the bot makes a request to the Fuseki server, that contains our Knowledge Base, with the completed query and receives a response from the server. To make the output more human-readable, as the response is in JSON format, we extract the values from it and lay it out as a text list which the chatbot will display onto the command terminal. As for dealing with exception cases, the bot has a few responses built in to handle them by replying to a message to communicate the issue with the user.

For the sample responses from the chatbot for the questions from the user, please see the appendix at the end. Note that for some of the responses, only a portion of it is shown.

7 References

[1] "RDF 1.1 Concepts and Abstract Syntax." [Online]. Available: https://www.w3.org/TR/rdf11-concepts/. [Accessed: Mar. 22, 2022]

[2] "RDF Schema 1.1." [Online]. Available: https://www.w3.org/TR/rdf-schema/. [Accessed: Mar. 22, 2022]

[3] "DCMI Schemas." [Online]. Available: https://www.dublincore.org/schemas/. [Accessed: Mar. 22, 2022]

[4] "Home," DBpedia Association. [Online]. Available: https://www.dbpedia.org/. [Accessed: Mar. 22, 2022]

[5] "FOAF Vocabulary Specification." [Online]. Available: http://xmlns.com/foaf/spec/. [Accessed: Mar. 22, 2022]

[6] "OWL Web Ontology Language Overview." [Online]. Available: https://www.w3.org/TR/owl-features/. [Accessed: Mar. 22, 2022]

[7] "vCard Ontology - for describing People and Organizations." [Online]. Available: https://www.w3.org/TR/vcard-rdf/. [Accessed: Mar. 22, 2022]

[8] "Wikidata." [Online]. Available: https://www.wikidata.org/wiki/Wikidata:Main_Page. [Accessed: Mar. 22, 2022]

[9] "W3C XML Schema Definition Language (XSD) 1.1 Part 1: Structures." [Online]. Available: https://www.w3.org/TR/xmlschema11-1/. [Accessed: Mar. 22, 2022]

[10] "Linked Open Vocabularies (LOV)." [Online]. Available: https://lov.linkeddata.es/dataset/lov/vocabs/vivo. [Accessed: Mar. 22, 2022]

[11] "Opendata - Administrative module." [Online]. Available: https://opendata.concordia.ca/datasets/. [Accessed: Mar. 22, 2022]

[12] "pdfplumber." https://github.com/jsvine/pdfplumber/ [accessed Apr. 11, 2022].

[13] "DBpedia Spotlight - Shedding light on the web of documents." https://www.dbpedia-spotlight.org/ [accessed Apr. 11, 2022].

[14] "spaCy · Industrial-strength Natural Language Processing in Python." https://spacy.io/ [accessed Apr. 11, 2022].

[15] M. Honnibal, I. Montani, S. Van Landeghem, and A. Boyd, spaCy: Industrial-strength Natural Language Processing in Python. 2020. Accessed: Apr. 11, 2022. [Online]. Available: https://github.com/explosion/spaCy/blob/d4196a62f198f0ec32239b238f32421bbb6eb942/spacy/glossary.py
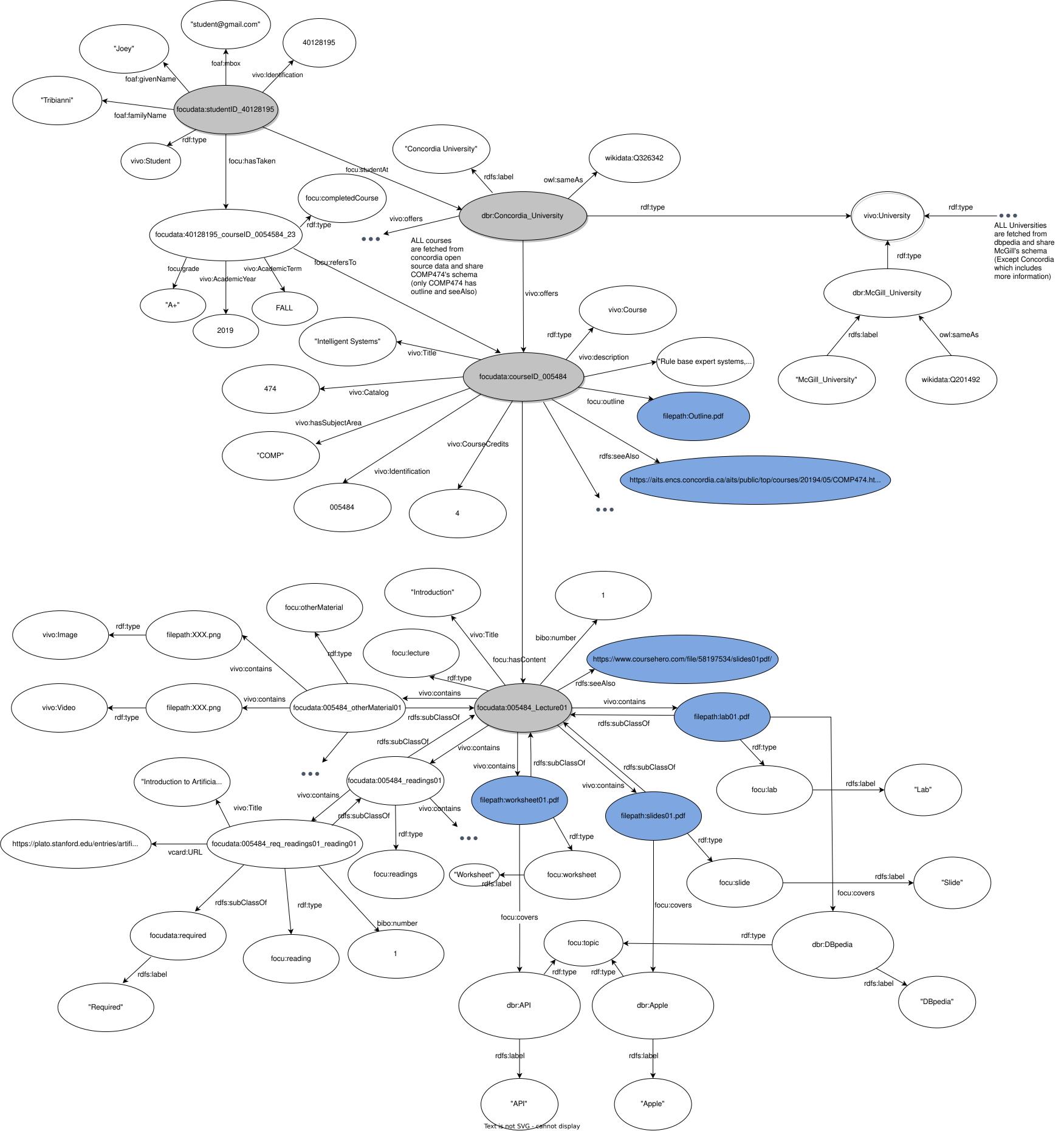
[15] "DBpedia Spotlight - Shedding light on the web of documents." https://www.dbpedia-spotlight.org/ [accessed Apr. 11, 2022].

8 Appendix

See next page

9 Graph

See final page

"Joey"

"student@gmail.com"

40128195

"Tribianni"

foaf:givenName

foaf:mbox

vivo:Identification

foaf:familyName

focudata:studentID_40128195

rdf:type

vivo:Student

focu:hasTaken

focu:studentAt

focu:completedCourse

"Concordia University"

wikidata:Q326342

rdfs:label

owl:sameAs

rdf:type

vivo:University

rdf:type

ALL Universities
are fetched from
dbpedia and share
McGill's schema
(Except Concordia
which includes
more information)

dbr:Concordia_University

vivo:offers

ALL courses
are fetched from
concordia open
source data and share
COMP474's schema
(only COMP474 has
outline and seeAlso)

rdf:type

focudata:40128195_courseID_0054584_23

focu:grade

vivo:AcademicYear

vivo:AcademicTerm

focu:refersTo

"A+"

2019

FALL

"Intelligent Systems"

vivo:Title

vivo:Course

vivo:description

"Rule base expert systems,...

rdf:type

vivo:offers

focudata:courseID_005484

474

vivo:Catalog

vivo:hasSubjectArea

"COMP"

vivo:Identification

005484

vivo:CourseCredits

4

focu:outline

filepath:Outline.pdf

rdfs:seeAlso

https://aits.encs.concordia.ca/aits/public/top/courses/20194/05/COMP474.ht...

dbr:McGill_University

rdfs:label

owl:sameAs

rdf:type

"McGill_University"

wikidata:Q201492

"Introduction"

1

bibo:number

https://www.coursehero.com/file/58197534/slides01pdf/

rdfs:seeAlso

focu:otherMaterial

focu:lecture

vivo:Title

rdf:type

focu:hasContent

vivo:Image

rdf:type

filepath:XXX.png

vivo:contains

vivo:Video

filepath:XXX.png

vivo:contains

rdf:type

focudata:005484_otherMaterial01

vivo:contains

rdfs:subClassOf

focudata:005484_Lecture01

vivo:contains

filepath:lab01.pdf

rdfs:subClassOf

rdf:type

focu:lab

rdfs:label

"Lab"

"Introduction to Artificia...

vivo:Title

focudata:005484_readings01

vivo:contains

rdfs:subClassOf

rdf:type

vivo:contains

rdfs:subClassOf

vivo:contains

rdfs:subClassOf

filepath:worksheet01.pdf

filepath:slides01.pdf

vivo:contains

https://plato.stanford.edu/entries/artifi...

vcard:URL

focudata:005484_req_readings01_reading01

rdfs:subClassOf

rdf:type

bibo:number

1

rdf:type

focu:readings

focu:worksheet

"Worksheet"

rdfs:label

rdf:type

focu:slide

rdfs:label

"Slide"

focu:covers

focudata:required

rdfs:label

rdf:type

focu:reading

"Required"

focu:covers

focu:topic

focu:covers

rdf:type

rdf:type

rdf:type

dbr:DBpedia

rdfs:label

"DBpedia"

dbr:API

dbr:Apple

rdfs:label

rdfs:label

"API"

"Apple"

Text is not SVG - cannot display

Appendix

Topic 1.1

```
Your input ->  What is COMP 474, that is offered by Concordia University, about?
No problem, the description for COMP 474 at Concordia University says:
Rule-based expert systems, blackboard architecture, and agent-based. Knowledge
acquisition and representation. Uncertainty and conflict resolution. Reasoning and
explanation. Design of intelligent systems. Project. Lectures: three hours per week.
Laboratory: two hours per week.
Prerequisite: COMP 352 or COEN 352.
```

Topic 1.2

```
Your input ->  Which topics is Trenae Bryan competent in?
Sure thing, Trenae Bryan is competent in the following topics:
    expertise
---  ----------------------------------
 0   Heidelberg
 1   Stuart Russell
 2   Diffbot
 3   Harper Collins
 4   Wikipedia
 5   API
 6   Oracle Spatial
 7   GeoNames
 8   ConceptNet
 9   Semantic Networks
10   AI Winter
11   Layer Cake
12   Apple
13   Alfred Lennon
14   Berlin
15   Sameer
16   Microsoft
17   The Glass Palace
18   A11
19   London
20   Peter Norvig
21   YAGO
22   IRI
23   Mona Lisa
24   Neo4J
25   Concordia
26   Sir George Williams University
27   Concordia University
28   Concordia University
29   CONCORDIA UNIVERSITY
30   DBpedia
31   DBpedia Spotlight
32   DBPedia
33   Winograd
34   Terry Winograd
35   French
36   PHP
37   A12
38   IBM
39   Rumelhart
40   AI
41   Intelligent Systems
42   A Notes
43   RDF
44   Resource Description Framework (RDF)
45   FOAF
46   Discovery
47   Liyang
48   TBox
49   Computer Science
50   RDF/XML
51   WordNet
52   Léonard de Vinci
53   Leonardo da Vinci
54   SHRDLU
55   Liverpool
56   le titre
57   Natural Language Processing (NLP)
58   NLP
59   natural language processing (NLP)
60   Amazon
```

```
 61  Prentice Hall
 62  WWW
 63  English language
 64  English
 65  XOR
 66  RDF Schema
 67  RDF schema
 68  ttl
 69  Jena
 70  Canada
 71  RDF triple
 72  RDF Triple
 73  Github
 74  GitHub
 75  UIMA
 76  Recommender Systems
 77  Knowledge Worker
 78  Gene Ontology
 79  Microsoft Tay
 80  ML
 81  Machine Learning
 82  Amazon Alexa
 83  Alexa
 84  Deep Learning
 85  Microsoft Cortana
 86  Jeopardy!
 87  Stanford
 88  ELIZA
 89  Steve Jobs
 90  MIT
 91  LOD
 92  Dublin Core
 93  McGill
 94  McGill College
 95  McGill University
 96  McGill University
 97  KNN
 98  kNN
 99  Concor
100  2D
101  Learning Curve
102  Naïve Bayes
103  Naive Bayes Classification
104  British
105  Enron
106  inference
107  DL
108  James Pustejovsky
109  Guantanamo Bay
110  Unsupervised
111  Unsupervised learning
112  Arthur
113  NSF
114  Pros & Cons
115  Chapter 7
116  CIA
117  Time complexity
118  Cambridge Analytica
119  Alison
120  Manhattan distance
121  False Positive
122  PDS
123  Elasticsearch
124  NuBus
125  Moodle
126  Newsgroup
127  TF-IDF
128  CAESAR
129  Christopher
130  Hamlet
131  Cambridge University Press
132  AP
133  Alag
134  BRUTUS
135  Tempest
136  John Berryman
137  Boolean model
138  IDF
139  Anthony Julius
140  CLEOPATRA
141  GUMO
142  Doug Turnbull
143  Prabhakar Raghavan
144  This week
145  Lego
146  EU
147  The Next Web
```

```
148  TED
149  Congress
150  thesauri
151  ACM
152  David Wood
153  TBL
154  The Artist
155  Morgan
156  loc
157  LOC
158  Unicode
159  Christian
160  Schema.org
161  Nexus
162  Uniform Resource Locator
163  ISO
164  Dewey Decimal
165  Luke
166  X5
167  Data Publishing
168  PE
169  Amsterdam
170  Milan
171  RT
172  Q5
173  RDB
174  BabelNet
175  James
176  OPE
177  Eötvös Loránd University
178  CSV
179  Springer International Publishing
180  IG
181  MusicBrainz
182  Tim Berners-Lee
183  LOD Datasets
184  Open Graph Protocol
185  Paris Hilton
186  API key
187  Quebec
188  NextProt
189  Loyola College
190  fuseki
191  Fuseki
192  Wordpress.com
193  Mexico
194  POST
195  National Cancer Institute
196  MAX
197  Amazon AWS
198  UniProt
199  QL
200  AVG
201  N-Quads
202  TriG
203  Web Ontology Language (OWL)
204  Paris
205  META tags
206  Mtl Blog
207  OpenCalais
208  JDK
209  xf
```

Topic 1.3

```
Your input ->  Which subjects at Concordia University teach DBpedia?
Okay, the following courses at Concordia University that teach DBpedia are:
     courseName          subjectArea    courseNum    frequency
 --  ------------------  ------------  -----------  -----------
  0  Intelligent Systems  COMP                 474           48
  1  INTRO TO A.I.        COMP                6721
```

Topic 1.4

```
Your input ->  What are all the courses with a COMP subject at Concordia Universit
Okay, the following courses at Concordia University that have COMP as the subject are:
      title                                                     subject    courseNum
 ---  --------------------------------------------------------  --------  -----------
   0  SELECTED TOPICS IN SOFTWARE                               COMP              749
   1  Techniques in Symbolic Computation                        COMP              367
```

2	Design and Analysis of Algorithms	COMP	465
3	PATTERN RECOGNITION	COMP	6731
4	COMPUTER VISION	COMP	425
5	Project and Report	COMP	6971
6	Introduction to Software Engineering	COMP	354
7	ADV. ANALYSIS OF ALOGARITHMS	COMP	7651
8	MACHINE LEARNING	COMP	6321
9	COMPUTER ARCHITECTURE	COMP	5261
10	Image Processing	COMP	478
11	NUMERIC ANALY/NONLINEAR EQUA	COMP	6361
12	Introduction to Theoretical Computer Science	COMP	335
13	ALGORITHM DESIGN TECHNIQUES	COMP	6651
14	Artificial Intelligence	COMP	472
15	Computer Science Project I	COMP	490
16	Data Analytics	COMP	333
17	MASTER S RESEARCH AND THESIS	COMP	7941
18	Computer Science Project II	COMP	492
19	PARALLEL ALGORITHMS+ARCHIT E	COMP	7241
20	PROJECT AND REPORT	COMP	6971
21	INTRO/KNOWLEDGE-BASE SYSTEMS	COMP	6591
22	ADV TOPICS MICROPROC SYSTEMS	COMP	427
23	Data Communication and Computer Networks	COMP	445
24	DOCTORAL RESEARCH AND THESIS	COMP	8901
25	SELECT TOP-DIGITAL SYSTEMS	COMP	729
26	Compiler Design	COMP	442
27	DISTRIBUTED SYSTEM DESIGN	COMP	6231
28	COMPUTER NETWORKS + PROTOCOL	COMP	6461
29	DISCRETE STR.+FORMAL LANG.	COMP	5361
30	TOOLS+TECHNIQUES / SW ENGR.	COMP	5541
31	SEL TOPICS-INFORMATION MANA	COMP	759
32	ADVANCED GAME DEVELOPMENT	COMP	6331
33	COMPUTER VISION	COMP	6341
34	Animation for Computer Games	COMP	477
35	Parallel Programming	COMP	428
36	TOPICS IN COMPUTER SCIENCE	COMP	499
37	ADVANCED PROGRAM DESIGN, C++	COMP	345
38	Computer Graphics	COMP	371
39	SEL TOPICS-COMP APPLICATIONS	COMP	779
40	MASTER S RESEARCH AND THESIS	COMP	7921
41	NATURAL LANGUAGE ANALYSIS	COMP	6751
42	SCIENTIFIC COMPUTATION	COMP	6351
43	COMP.ANAL.NATURAL LANG.TEST	COMP	690
44	Computer Architecture	COMP	326
45	INTELLIGENT SYSTEMS	COMP	6741
46	Multicore Programming	COMP	426
47	Image Processing	COMP	6771
48	ADV IMAGE PROC	COMP	7781
49	APPL./SYMBOLIC+ALGEB.COMPU N	COMP	6611
50	Object-Oriented Programming II	COMP	249
51	ADVANCED PROGRAMMING	COMP	5421
52	Program and Problem Solving	COMP	6481
53	OPERATING SYSTEMS	COMP	5461
54	Fundamentals of Programming	COMP	218
55	Computer Science Industrial Experience Reflective Learning I	COMP	108
56	DOCTORAL RESEARCH AND THESIS	COMP	890
57	GRADUATE SEMINAR-COMP.SC.	COMP	6961
58	FOUNDATIONS/SEMANTIC WEB	COMP	6531
59	COMPARAT.STUDY/PROGRAM.LANG.	COMP	6411
60	Honours Seminar	COMP	495
61	Object-Oriented Programming I	COMP	248
62	PRINCIPLES/DATA STRUCTURES	COMP	5511
63	Operating Systems	COMP	346
64	PROGRAM G + PROBLEM SOLVING	COMP	5481
65	TOPICS IN COMP. SCIENCE II	COMP	791
66	Advanced Game Development	COMP	476
67	ADV.DATABASE TECH. AND APPL.	COMP	6521
68	COMBINATORIAL ALGORITHMS	COMP	6661
69	THEORY OF COMPUTATION	COMP	6641
70	Intelligent Systems	COMP	474
71	COMBINATORICS	COMP	339
72	COMP. ORGANIZ N+ASSEMB.LANG.	COMP	5201
73	PARALLEL PROGRAMMING	COMP	6281
74	MASTER S RESEARCH AND THESIS	COMP	792
75	Bioinformatics Databases and Systems	COMP	6821
76	INFO. RETRIEVAL & WEB SEARCH	COMP	6791
77	Machine Learning	COMP	432
78	Probability and Statistics for Computer Science	COMP	233
79	SEL TOP - NUMERICAL COMPUTAT	COMP	769
80	DB SYSTEMS PRINCIPLES	COMP	7531
81	TOPICS/COMPUTER SCIENCE II	COMP	790
82	Digital Geometric Modelling	COMP	6381
83	ANIMATION FOR COMPUTER GAMES	COMP	6311
84	SEL TOP-THEORETICAL COMP SCI	COMP	739
85	Pattern Recognition	COMP	473
86	Computer Science Industrial Experience Reflective Learning II	COMP	208
87	FILES AND DATABASES	COMP	5531
88	ELEMENTARY NUMERICAL METHODS	COMP	5611

89	Elementary Numerical Methods	COMP	361
90	Databases	COMP	353
91	Principles of Programming Languages	COMP	348
92	TOPICS/COMPUTER SCIENCE	COMP	691
93	System Hardware	COMP	228
94	INTRO TO A.I.	COMP	6721
95	Introduction to Game Development	COMP	376
96	Data Structures and Algorithms	COMP	352
97	BIOINFORMATICS ALGORITHMS	COMP	6811
98	ADVANCED COMPUTER GRAPHICS	COMP	6761
99	COMPILER DESIGN	COMP	6421
100	Information Retrieval and Web Search	COMP	479
101	COMP 6781 Statistical Natural Language Processing	COMP	6781
102	Introduction to Computing	COMP	201
103	TOPICS IN COMPUTER SCIENCE	COMP	498
104	Mathematics for Computer Science	COMP	232
105	LARGE-SCALE OPTIMIZATION	COMP	6631
106	SELECTED TOPICS IN SOFTWARE	COMP	749
107	Techniques in Symbolic Computation	COMP	367
108	Design and Analysis of Algorithms	COMP	465
109	PATTERN RECOGNITION	COMP	6731
110	COMPUTER VISION	COMP	425
111	Project and Report	COMP	6971
112	Introduction to Software Engineering	COMP	354
113	ADV. ANALYSIS OF ALOGARITHMS	COMP	7651
114	MACHINE LEARNING	COMP	6321
115	COMPUTER ARCHITECTURE	COMP	5261
116	Image Processing	COMP	478
117	NUMERIC ANALY/NONLINEAR EQUA	COMP	6361
118	Introduction to Theoretical Computer Science	COMP	335
119	ALGORITHM DESIGN TECHNIQUES	COMP	6651
120	Artificial Intelligence	COMP	472
121	Computer Science Project I	COMP	490
122	Data Analytics	COMP	333
123	MASTER S RESEARCH AND THESIS	COMP	7941
124	Computer Science Project II	COMP	492
125	PARALLEL ALGORITHMS+ARCHIT E	COMP	7241
126	PROJECT AND REPORT	COMP	6971
127	INTRO/KNOWLEDGE-BASE SYSTEMS	COMP	6591
128	ADV TOPICS MICROPROC SYSTEMS	COMP	427
129	Data Communication and Computer Networks	COMP	445
130	DOCTORAL RESEARCH AND THESIS	COMP	8901
131	SELECT TOP-DIGITAL SYSTEMS	COMP	729
132	Compiler Design	COMP	442
133	DISTRIBUTED SYSTEM DESIGN	COMP	6231
134	COMPUTER NETWORKS + PROTOCOL	COMP	6461
135	DISCRETE STR.+FORMAL LANG.	COMP	5361
136	TOOLS+TECHNIQUES / SW ENGR.	COMP	5541
137	SEL TOPICS-INFORMATION MANA	COMP	759
138	ADVANCED GAME DEVELOPMENT	COMP	6331
139	COMPUTER VISION	COMP	6341
140	Animation for Computer Games	COMP	477
141	Parallel Programming	COMP	428
142	TOPICS IN COMPUTER SCIENCE	COMP	499
143	ADVANCED PROGRAM DESIGN, C++	COMP	345
144	Computer Graphics	COMP	371
145	SEL TOPICS-COMP APPLICATIONS	COMP	779
146	MASTER S RESEARCH AND THESIS	COMP	7921
147	NATURAL LANGUAGE ANALYSIS	COMP	6751
148	SCIENTIFIC COMPUTATION	COMP	6351
149	COMP.ANAL.NATURAL LANG.TEST	COMP	690
150	Computer Architecture	COMP	326
151	INTELLIGENT SYSTEMS	COMP	6741
152	Multicore Programming	COMP	426
153	Image Processing	COMP	6771
154	ADV IMAGE PROC	COMP	7781
155	APPL./SYMBOLIC+ALGEB.COMPU N	COMP	6611
156	Object-Oriented Programming II	COMP	249
157	ADVANCED PROGRAMMING	COMP	5421
158	Program and Problem Solving	COMP	6481
159	OPERATING SYSTEMS	COMP	5461
160	Fundamentals of Programming	COMP	218
161	Computer Science Industrial Experience Reflective Learning I	COMP	108
162	DOCTORAL RESEARCH AND THESIS	COMP	890
163	GRADUATE SEMINAR-COMP.SC.	COMP	6961
164	FOUNDATIONS/SEMANTIC WEB	COMP	6531
165	COMPARAT.STUDY/PROGRAM.LANG.	COMP	6411
166	Honours Seminar	COMP	495
167	Object-Oriented Programming I	COMP	248
168	PRINCIPLES/DATA STRUCTURES	COMP	5511
169	Operating Systems	COMP	346
170	PROGRAM G + PROBLEM SOLVING	COMP	5481
171	TOPICS IN COMP. SCIENCE II	COMP	791
172	Advanced Game Development	COMP	476
173	ADV.DATABASE TECH. AND APPL.	COMP	6521
174	COMBINATORIAL ALGORITHMS	COMP	6661
175	THEORY OF COMPUTATION	COMP	6641

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176  Intelligent Systems                                               COMP       474
177  COMBINATORICS                                                     COMP       339
178  COMP. ORGANIZ N+ASSEMB.LANG.                                      COMP      5201
179  PARALLEL PROGRAMMING                                              COMP      6281
180  MASTER S RESEARCH AND THESIS                                      COMP       792
181  Bioinformatics Databases and Systems                             COMP      6821
182  INFO. RETRIEVAL & WEB SEARCH                                      COMP      6791
183  Machine Learning                                                  COMP       432
184  Probability and Statistics for Computer Science                  COMP       233
185  SEL TOP - NUMERICAL COMPUTAT                                      COMP       769
186  DB SYSTEMS PRINCIPLES                                             COMP      7531
187  TOPICS/COMPUTER SCIENCE II                                        COMP       790
188  Digital Geometric Modelling                                       COMP      6381
189  ANIMATION FOR COMPUTER GAMES                                      COMP      6311
190  SEL TOP-THEORETICAL COMP SCI                                      COMP       739
191  Pattern Recognition                                               COMP       473
192  Computer Science Industrial Experience Reflective Learning II     COMP       208
193  FILES AND DATABASES                                               COMP      5531
194  ELEMENTARY NUMERICAL METHODS                                      COMP      5611
195  Elementary Numerical Methods                                      COMP       361
196  Databases                                                         COMP       353
197  Principles of Programming Languages                               COMP       348
198  TOPICS/COMPUTER SCIENCE                                           COMP       691
199  System Hardware                                                   COMP       228
200  INTRO TO A.I.                                                     COMP      6721
201  Introduction to Game Development                                  COMP       376
202  Data Structures and Algorithms                                    COMP       352
203  BIOINFORMATICS ALGORITHMS                                         COMP      6811
204  ADVANCED COMPUTER GRAPHICS                                        COMP      6761
205  COMPILER DESIGN                                                   COMP      6421
206  Information Retrieval and Web Search                              COMP       479
207  COMP 6781 Statistical Natural Language Processing                COMP      6781
208  Introduction to Computing                                         COMP       201
209  TOPICS IN COMPUTER SCIENCE                                        COMP       498
210  Mathematics for Computer Science                                 COMP       232
211  LARGE-SCALE OPTIMIZATION                                          COMP      6631
```

Topic 1.5

```
Your input ->  How many students are enrolled in each course that is offered by Concordia University?
Here's the list of placeholder courses offered by Concordia University and the number of students enrolled in each one:
     subject    catalog     count
--  ---------  ---------  -------
 0  ACCO        220          5
 1  ACCO        230          4
 2  ACCO        240          6
 3  ACCO        310          4
 4  ACCO        320          4
 5  ACCO        330          3
 6  ACCO        340          6
 7  ACCO        350          1
 8  ACCO        355          6
 9  ACCO        360          3
10  ACCO        365          6
11  ACCO        400          5
12  ACCO        420          4
13  ACCO        425          6
14  ACCO        430          3
15  ACCO        435          4
16  ACCO        440          8
17  ACCO        450          3
18  ACCO        455          5
19  ACCO        465          7
20  ACCO        470          2
21  ACCO        471          2
22  ACCO        495          2
23  ACCO        590          4
24  ACCO        595          6
25  ACCO        600         17
26  ACCO        601          4
27  ACCO        602         11
28  ACCO        603          5
29  ACCO        604          3
30  ACCO        605          8
31  ACCO        606          5
32  ACCO        607          2
33  ACCO        608          7
34  ACCO        609          4
35  ACCO        631          6
36  ACCO        631T         2
37  ACCO        635          5
38  ACCO        635T         3
39  ACCO        643X         6
```

```
40  ACCO      650            2
41  ACCO      650T          11
42  ACCO      651            4
43  ACCO      651T           6
44  ACCO      652            5
45  ACCO      652T           3
46  ACCO      653            4
47  ACCO      653T           5
48  ACCO      654            5
49  ACCO      654T          10
50  ACCO      655            3
51  ACCO      655T           4
52  ACCO      656            6
53  ACCO      656T           5
54  ACCO      657            3
55  ACCO      657T           8
56  ACCO      658            7
57  ACCO      658T           1
58  ACCO      659            4
59  ACCO      659T           3
60  ACCO      672            8
61  ACCO      681            3
62  ACCO      682            3
63  ACCO      685            5
64  ACCO      690B           5
65  ACCO      691            6
66  ACCO      692            6
67  ACCO      695            6
68  ACTT      201            8
69  ACTT      202            6
70  ACTT      209            9
71  ACTT      210            9
72  ACTT      211            7
73  ACTT      231            9
74  ACTT      298            3
75  ACTT      299            2
76  ACTT      321            8
77  ACTT      325           10
78  ACTT      331            5
79  ACTT      332            6
80  ACTT      355            2
81  ACTT      358           18
82  ACTT      360           11
83  ACTT      370            5
84  ACTT      372            3
85  ACTT      398            7
86  ACTT      399            5
87  ACTT      432            7
88  ACTT      433            9
89  ACTT      434            9
90  ACTT      435            9
91  ACTT      436           11
92  ACTT      437            7
93  ACTT      438            9
94  ACTT      440           10
95  ACTT      450            9
96  ACTT      455            7
97  ACTT      458            5
98  ACTT      460           10
99  ACTT      461            5
```

Topic 1.6

```
Your input ->  What courses are worth 4.0 credits at Concordia University?
Here's the list of courses offered by Concordia University that are worth 4.0 credits:
     title                                                  subject   courseNum    credit
--  -------------------------------------------------------  ---------  -----------  --------
 0  NONLINEAR SYSTEMS                                        ENGR      6141            4
 1  TUTORIAL IN INF SYS/INT.CONT                            ACCO      603             4
 2  CAPSTONE AEROSPACE ENGINEERING DESIGN PROJECT           AERO      490             4
 3  HEAT EXCHANGER DESIGN                                   MECH      6141            4
 4  Introduction to Flight and Aerospace System            AERO      201             4
 5  SPEC MASTER'S LEVEL STUDIES                             SPEC      644             4
 6  VLSI Circuit Design                                     COEN      451             4
 7  PATTERN RECOGNITION                                     COMP      6731            4
 8  COMPUTER VISION                                         COMP      425             4
 9  MICROTRANSDUCER PROCESS TECH                            ELEC      6251            4
10  ANALYTICAL METH ECOTOXICOLOG                            CHEM      618             4
11  Building Information Modelling in Construction          BLDG      6241            4
12  Project and Report                                      COMP      6971            4
13  READING COURSE IN ALGEBRA                               MATH      697             4
14  VIBR. PROB. IN ROTAT. MACH.                             MECH      6301            4
15  SYSTEMS REQMT. SPECIFICATION                            SOEN      6481            4
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16  Corrosion and Oxidation of Metals                            MECH    6571         4
17  Advanced Functions in R                                      GPDI    547          4
18  JOIN G PROC+NONDESTRUC.TEST.                                 MECH    6541         4
19  The Finite Element Method in Computational Fluid Dynamics    ENGR    6261         4
20  VLSI PROCESS TECHNOLOGY                                      ELEC    6241         4
21  MODEL./BLDG.+ENVIROM L ENGG.                                 CIVI    6601         4
22  SPEC DOCTORAL LEVEL STUDIES                                  SPEC    840          4
23  Distributed Systems                                          SOEN    423          4
24  ENGINEERING ANALYSIS                                         ENCS    6021         4
25  VIRTUAL SYSTEMS                                              MECH    6041         4
26  HEAT TRANSFER                                                BLDG    6541         4
27  ENGG.ASPECTS/SITE REMEDIA N.                                 CIVI    6491         4
28  ENG. FRACTURE MECH.+FATIGUE                                  MECH    6641         4
29  ADVANCED COLLOID AND INTERFACE SCIENCE AND ENGINEERING       CHME    6131         4
30  INTRO TO TRIBOLOGY                                           MECH    6431         4
31  SUSTAINABLE INFRASTRUCTURE                                   INSE    6311         4
32  Introduction to Software Engineering                         COMP    354          4
33  ADV. ANALYSIS OF ALOGARITHMS                                 COMP    7651         4
34  BUSINESS ADVISORY SERVICES                                   ACCO    631          4
35  INTRODUCTION TO ANALOG VLSI                                  ELEC    6051         4
36  AUTONOMY FOR MOBILE ROBOTS                                   ENGR    6412         4
37  PROCESS DYNAMICS+CONTROL                                     MECH    6051         4
38  HYBRID ELECTRIC VEHICLE POWER SYSTEM DESIGN AND CONTROL      ELEC    6471         4
39  Taxation and Decision-Making                                 ACCO    655          4
40  LEAN MANUFACTURING                                           INDU    6241         4
41  ADV. CONCEPTS/QUALITY IMPR.                                  INDU    6341         4
42  MACHINE LEARNING                                             COMP    6321         4
43  Tutorial in Performance Management                           ACCO    656T         4
44  SOLAR BUILDING MODELLING AND DESIGN                          BLDG    6951         4
45  Image Processing                                             COMP    478          4
46  STRESS ANALYSIS/MECH DESIGN                                  MECH    6441         4
47  The Finite Element Method in Structural Mechanics            ENGR    6531         4
48  NUMERIC ANALY/NONLINEAR EQUA                                 COMP    6361         4
49  Facilities Planning and Warehouse Operations                 INDU    6251         4
50  Financial Strategies and Decisions                           ACCO    657          4
51  SVCS COM: FOUND, DSGN & IMPL                                 SOEN    6861         4
52  Tutorial in Capstone II Examination                          ACCO    609          4
53  INDUSTRIALIZED BUILDING                                      BLDG    6641         4
54  INDOOR AIR QUAL.+ VENT.                                      BLDG    6751         4
55  VLSI CIRCUIT DESIGN                                          COEN    6511         4
56  AVIONIC SYSTEMS DESIGN                                       ENGR    7461         4
57  SELECTED TOP-INORGANIC CHEM                                  CHEM    647          4
58  DESIGN OF TRANSPORTATION TERMINALS                           CIVI    7401         4
59  MEDICAL IMAGE PROCESSING                                     ELEC    6661         4
60  CONSTRUCTION PROCESSES                                       BLDG    6831         4
61  Tutorial in Performance Management                           ACCO    606          4
62  ALGORITHM DESIGN TECHNIQUES                                  COMP    6651         4
63  KINETIC THEORY OF GASES                                      MECH    6101         4
64  MECHANICS+BIOL. TISSUES                                      MECH    6361         4
65  OCCUPATIONAL SAFETY ENG.                                     INDU    6421         4
66  PRIN. OF SLID ST NA.DEV                                      ELEC    6281         4
67  Artificial Intelligence                                      COMP    472          4
68  SCHEDULING THEORY                                            INDU    6231         4
69  DECISION ANALYSIS                                            BLDG    6581         4
70  INFO. THEORY + SOURCE CODING                                 ELEC    6151         4
71  PROJECT ACQUISITION+CONTROL                                  BLDG    7811         4
72  Tutorial in Taxation/Decision making                         ACCO    605          4
73  TRANS. SYSTEMS ANALYSIS                                      CIVI    6401         4
74  SPECIAL TOPIC: CELL BIOLOGY                                  SPEC    843          4
75  INFORMATION TECHNOLOGY APPLICATIONS IN CONSTRUCTION          BLDG    7841         4
76  MICROWAVE ENGINEERING                                        ELEC    6391         4
77  DEVELOPMENT & GLOBAL ENGR.                                   ENCS    6821         4
78  INFORMATION SYSTEMS SECURITY CYBERCRIME INVESTIGATION        INSE    6610         4
79  MODAL ANALYSIS/MECH.SYSTEMS                                  MECH    6351         4
80  SPEC MASTER'S LEVEL STUDIES                                  SPEC    649          4
81  LOGISTICS NETWORK MODELS                                     INDU    6141         4
82  TWO-DIMEN'AL SIG & IMAGE PRO                                 ELEC    6641         4
83  SYSTEM RELIABILITY                                           INDU    6351         4
84  Embedded Systems and Software Design                         COEN    421          4
85  OPT.NETWK: ARCH. & PROTOCOLS                                 ENCS    6811         4
86  TRUSTED COMPUTING                                            INSE    6650         4
87  PARALLEL ALGORITHMS+ARCHIT E                                 COMP    7241         4
88  Smart Grids and Control System Security                      INSE    6640         4
89  DISCRETE OPTIMIZATION                                        INDU    6361         4
90  SOFTWARE RE-ENGINEERING                                      SOEN    6021         4
91  PLAN.+ DESIGN OF BRIDGES                                     CIVI    6101         4
92  EMBEDDED SYSTEM MODELLING                                    COEN    6341         4
93  LEAN ENTERPRISE                                              INDU    6221         4
94  SPEC MASTER'S LEVEL STUDIES                                  SPEC    652          4
95  WIRELESS NETWORK SECURITY                                    INSE    6190         4
96  SELECTED TOP:ECOTOXICOLOGY I                                 BIOL    572          4
97  ADVANCED MATERIALS                                           MECH    6501         4
98  BUILDING ILLUMINATION                                        BLDG    6731         4
99  COMP.AIDED BUILD. DESIGN                                     BLDG    6591         4
```

Topic 1.7

```
Your input ->  What are the topics of COMP 474 at Concordia University?
     label
--- -----------------------------------
  0  Heidelberg
  1  Stuart Russell
  2  Diffbot
  3  Harper Collins
  4  Wikipedia
  5  API
  6  Oracle Spatial
  7  GeoNames
  8  ConceptNet
  9  Semantic Networks
 10  AI Winter
 11  Layer Cake
 12  Apple
 13  Alfred Lennon
 14  Berlin
 15  Sameer
 16  Microsoft
 17  The Glass Palace
 18  A11
 19  London
 20  Peter Norvig
 21  YAGO
 22  IRI
 23  Mona Lisa
 24  Neo4J
 25  Concordia
 26  Sir George Williams University
 27  Concordia University
 28  Concordia University
 29  CONCORDIA UNIVERSITY
 30  DBpedia
 31  DBpedia Spotlight
 32  DBPedia
 33  Winograd
 34  Terry Winograd
 35  French
 36  PHP
 37  A12
 38  IBM
 39  Rumelhart
 40  AI
 41  Intelligent Systems
 42  A Notes
 43  RDF
 44  Resource Description Framework (RDF)
 45  FOAF
 46  Discovery
 47  Liyang
 48  TBox
 49  Computer Science
 50  RDF/XML
 51  WordNet
 52  Léonard de Vinci
 53  Leonardo da Vinci
 54  SHRDLU
 55  Liverpool
 56  le titre
 57  Natural Language Processing (NLP)
 58  NLP
 59  natural language processing (NLP)
 60  Amazon
 61  Prentice Hall
 62  WWW
 63  English language
 64  English
 65  XOR
 66  RDF Schema
 67  RDF schema
 68  ttl
 69  Jena
 70  Canada
 71  RDF triple
 72  RDF Triple
 73  Github
 74  GitHub
 75  UIMA
 76  Recommender Systems
 77  Knowledge Worker
 78  Gene Ontology
 79  Microsoft Tay
```

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 80  ML
 81  Machine Learning
 82  Amazon Alexa
 83  Alexa
 84  Deep Learning
 85  Microsoft Cortana
 86  Jeopardy!
 87  Stanford
 88  ELIZA
 89  Steve Jobs
 90  MIT
 91  LOD
 92  Dublin Core
 93  McGill
 94  McGill College
 95  McGill University
 96  McGill University
 97  KNN
 98  kNN
 99  Concor
100  2D
101  Learning Curve
102  Naïve Bayes
103  Naive Bayes Classification
104  British
105  Enron
106  inference
107  DL
108  James Pustejovsky
109  Guantanamo Bay
110  Unsupervised
111  Unsupervised learning
112  Arthur
113  NSF
114  Pros & Cons
115  Chapter 7
116  CIA
117  Time complexity
118  Cambridge Analytica
119  Alison
120  Manhattan distance
121  False Positive
122  PDS
123  Elasticsearch
124  NuBus
125  Moodle
126  Newsgroup
127  TF-IDF
128  CAESAR
129  Christopher
130  Hamlet
131  Cambridge University Press
132  AP
133  Alag
134  BRUTUS
135  Tempest
136  John Berryman
137  Boolean model
138  IDF
139  Anthony Julius
140  CLEOPATRA
141  GUMO
142  Doug Turnbull
143  Prabhakar Raghavan
144  This week
145  Lego
146  EU
147  The Next Web
148  TED
149  Congress
150  thesauri
151  ACM
152  David Wood
153  TBL
154  The Artist
155  Morgan
156  loc
157  LOC
158  Unicode
159  Christian
160  Schema.org
161  Nexus
162  Uniform Resource Locator
163  ISO
164  Dewey Decimal
165  Luke
166  X5
```

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167  Data Publishing
168  PE
169  Amsterdam
170  Milan
171  RT
172  Q5
173  RDB
174  BabelNet
175  James
176  OPE
177  Eötvös Loránd University
178  CSV
179  Springer International Publishing
180  IG
181  MusicBrainz
182  Tim Berners-Lee
183  LOD Datasets
184  Open Graph Protocol
185  Paris Hilton
186  API key
187  Quebec
188  NextProt
189  Loyola College
190  fuseki
191  Fuseki
192  Wordpress.com
193  Mexico
194  POST
195  National Cancer Institute
196  MAX
197  Amazon AWS
198  UniProt
199  QL
200  AVG
201  N-Quads
202  TriG
203  Web Ontology Language (OWL)
204  Paris
205  META tags
206  Mtl Blog
207  OpenCalais
208  JDK
209  xf
```

Topic 1.8

```
Your input ->  Which students have retaken the same course at least 2 times?
Here's all students that have retaken a course at least 2 times:
     subjectArea   catalog   firstName    lastName      studentId    nbTimesTaken
---  ------------- --------- ----------- ----------- ----------- --------------
  0  AHSC          330       Breia        Crowell       43248687              2
  1  ANTH          270       Sanya        Ray           41103045              2
  2  ANTH          345       Sinead       Thomas        47855211              2
  3  ANTH          472       Danee        Lam           41687401              2
  4  SOCI          472       Danee        Lam           41687401              2
  5  ARTH          200       Tiwanna      Phelps        42266030              2
  6  ARTH          266       Romy         Spence        43970807              2
  7  ATRP          624       Keane        Lowry         45656225              2
  8  BIOL          227       Brandelyn    Williford     46414172              2
  9  BIOL          350       Mahmoud      Scarborough   44328251              2
 10  BIOL          351       Lorilei      Bishop        47062293              2
 11  BLDG          365       Sheren       Mitchell      43177841              2
 12  BLDG          6071      Evalina      Bruce         44111281              2
 13  CART          212       Stepahnie    Bradford      48779825              2
 14  CHEM          221       Therron      Brandon       49621189              2
 15  CIVI          432       Jameca       Golden        49370084              2
 16  CIVI          483       Sherard      Gilliam       47931566              2
 17  COEN          313       Brandelyn    Williford     46414172              2
 18  COEN          313       Gladis       Frazier       49832947              2
 19  COMP          249       Leshay       Marks         43331314              2
 20  COMP          346       Sarkis       Peele         49107786              2
 21  COMP          445       Linsday      Petersen      42884783              2
 22  COMP          5481      Viliami      Boyette       41656779              2
 23  COMS          240       Agustine     Alexander     41630765              2
 24  COMS          370       Stevi        Dunn          48964072              2
 25  COMS          695B      Teressa      Manning       41358236              2
 26  COMS          861       Lacye        Yu            43152116              2
 27  DANC          301       Justeen      Moon          49857777              2
 28  ECON          615       Zachariah    Braswell      49092469              2
 29  ECON          662       Hollyann     Sutton        43446352              2
 30  ELEC          442       Jaquitta     Cobb          46215613              2
 31  ENGL          384       Serena       Raynor        47414185              2
 32  ENGL          441       Charese      Wood          44351512              2
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33	ENGL	451	Joann	Ivey	44523268	2
34	ENGL	646	Shunda	May	49777638	2
35	ENGR	6411	Cherita	Herndon	41217532	2
36	ESTU	608	Venessa	Brantley	46985710	2
37	ETEC	536	Su	Dickens	45922911	2
38	ETEC	640	Jessieca	Rodriguez	44346566	2
39	ETEC	650	Dustyn	Brennan	43478189	2
40	EXCI	460	Adrienne	Brooks	41354838	2
41	FINA	320	Lavanda	Mathews	45650811	2
42	FLIT	230	Emmanuelle	Hurley	43248110	2
43	FLIZ	230	Emmanuelle	Hurley	43248110	2
44	FPST	297	Garrett	Morris	49501430	2
45	FRAN	215	Rami	Hull	44448879	2
46	FTRA	202	Nicholai	Yates	43988012	2
47	GEOL	210	Robertson	Swanson	49670104	2
48	GERM	270	Dewan	Connor	48636591	2
49	GERM	305	Orrin	Porter	42867964	2
50	HIST	201	Nickolaus	Wyatt	45946783	2
51	HISZ	201	Nickolaus	Wyatt	45946783	2
52	HIST	235	Keishawna	Morrison	49661907	2
53	HIST	277	Takara	Nolan	41477344	2
54	HIST	281	Jonisha	Pridgen	48300318	2
55	HISZ	281	Jonisha	Pridgen	48300318	2
56	HIST	340	Tho	Christian	43356669	2
57	HIST	365	Kyron	Adkins	46982724	2
58	HUMA	863	Kavita	Kuhn	47032123	2
59	INDU	490	Gertrude	Middleton	46328769	2
60	IRST	203	Jesselyn	Waller	46953764	2
61	MECH	311	Adaliz	Mullins	46076353	2
62	PHIL	609	Tyreka	Perez	43713212	2
63	POLI	216	Sheretta	Hampton	49097045	2
64	POLI	409	Courteney	Dickson	45967499	2
65	POLI	426	Vien	Rao	46187290	2
66	POLI	600	Loren	Godfrey	43303362	2
67	POLI	607	Yasir	Riggs	49074971	2
68	PSYC	250	Robertson	Swanson	49670104	2
69	PSYC	444	Omarr	Wilkins	46167225	2
70	PSYC	487	Terrall	Blake	42256310	2
71	PSYC	495	Rosalva	Rodgers	43147943	2
72	PSYC	801	Taquita	Creech	44602117	2
73	PSYC	823	Toy	Maynard	40188854	2
74	RELI	209	Jaquilla	Gorman	42935367	2
75	RELI	366	Sherlyn	Vaughn	47188616	2
76	SCUL	490	Colena	Russell	47761423	2
77	SOCI	203	Audrey	Starr	41164798	2
78	SOCZ	203	Audrey	Starr	41164798	2
79	ANTH	276	Taiwo	Atkins	48183647	2
80	SOCI	276	Taiwo	Atkins	48183647	2
81	ANTH	381	Rashi	Schmidt	45112117	2
82	SOCI	381	Rashi	Schmidt	45112117	2
83	SOEN	228	Cornelious	Locklear	45251717	2
84	SOEN	490	Wanda	Mills	47201164	2
85	SPEC	601	Odette	Lynn	47693867	2
86	SPEC	835	Truman	Brady	40180367	2
87	STAT	250	Smita	Chan	45431677	2
88	TESL	324	Kima	Sanchez	46226538	2
89	TESL	486	Travell	West	46861855	2
90	THEO	236	Avalon	Sanders	46978272	2
91	THEO	322	Brean	Bullock	49980093	2
92	TRES	582	Celicia	Carr	47840304	2
93	CEWD	229	Kirsten	Simon	42444526	2
94	COMS	694	Glen	Snyder	48082836	2
95	ELEC	6391	Chalea	Kearney	45333591	2
96	ETEC	593K	Alacia	Dudley	46255616	2
97	HIST	225	Traniece	Donovan	48612768	2
98	INDI	801	Billyjoe	Barnes	44377786	2
99	INDI	829	Nadja	Potter	42076872	2
100	MECH	6251	Curran	Burgess	40159965	2
101	MUSI	472	Titania	Weaver	44790118	2
102	PSYC	850C	Pessy	Heller	46608061	2
103	RELI	601B	Tanara	Berman	41081117	2
104	ACCO	653T	Tyanne	Miller	41754691	2
105	ADED	489	Myishia	Singer	48519905	2
106	ARTH	803	Sharisse	Chase	49819684	2
107	CHST	625	Davy	Snow	48167830	2
108	EXCI	493	Carlus	Faulkner	45782429	2
109	FMST	332	Raniesha	Wilkinson	47083256	2
110	FMST	610	Analissa	Kim	46070927	2
111	INTE	298	Hadley	Klein	45522578	2
112	LIBS	498	Berta	Capps	44951559	2
113	POLI	499	Lawerence	Fisher	43036372	2
114	PSYC	228	Sherley	Shepherd	41407134	2
115	SCPA	298	Pa	Carlson	41075698	2
116	TDEV	398	Leandrea	Howe	41397747	2
117	HISW	205	Cedar	McBride	49538341	2
118	HISW	251	Gus	Rosen	42871831	2
119	INDI	639B	Darril	Barnett	48541329	2

```
120  FBRS    386      Rami        Hull        44448879           2
121  ELEC    367      Jaamal      McNamara    42004164           2
122  PERC    209      Chalon      Monroe      43045045           2
123  PERC    498      Nichlos     Forrest     46504129           2
124  FTRA    638      Kima        Sanchez     46226538           2
125  COMP    6331     Lyle        McAllister  49376844           2
126  GPTK    714      Travers     Lawrence    41871544           2
127  COMS    484      Brean       Bullock     49980093           2
128  GEOG    264      Ellena      Stanton     43729289           2
129  GPLL    38       Trenae      Bryan       44166698           2
130  SSOQ    609      Hobie       Johnson     47747097           2
131  BIOL    476      Sheren      Mitchell    43177841           2
132  COMP    432      Latavia     Harrell     43119582           2
133  INDU    6521     Kirsten     Simon       42444526           2
134  MIAE    221      Shonika     Duncan      42720631           2
135  CEPS    1105EO   Kellis      Davies      44331863           2
136  ACCO    220      Artisha     Anderson    47842519           1
137  ACCO    220      Jemaine     Roach       49453432           1
138  ACCO    220      Jodi        Scott       47495787           1
139  ACCO    220      Karlyn      Merrill     41588547           1
140  ACCO    220      Karra       Boyer       49004841           1
141  ACCO    230      Claudy      Rosenthal   41918453           1
142  ACCO    230      Lily        Welsh       44331134           1
143  ACCO    230      Pierce      Moran       41623212           1
144  ACCO    230      Roxana      Hawkins     41221982           1
145  ACCO    240      Bernadette  Bradley     45836201           1
146  ACCO    240      Gabriel     Browning    48317725           1
147  ACCO    240      Keidra      Lawson      48350817           1
148  ACCO    240      Lyndsi      Braun       40771970           1
149  ACCO    240      Shanette    McDaniel    42090163           1
```

Topic 1.9

```
Your input ->  Which students have failed SOCI 336 at Concordia University
Here's all students that have failed SOCI 336 at Concordia University:
    firstName   lastName     studentId  subjectArea    catalog  grade
-- ----------- ---------- ----------- ------------- --------- -------
 0  Mariela     Morrow      43952942 SOCI              336  F
```

Topic 1.10

```
Your input ->  What is COMP 474, that is offered by Concordia University, about?
No problem, the description for COMP 474 at Concordia University says:
Rule-based expert systems, blackboard architecture, and agent-based. Knowledge acquisition and representation. Uncertainty and conflic
ours per week. Laboratory: two hours per week.
Prerequisite: COMP 352 or COEN 352.
```

Topic 2.1

see topic 1.1 - 1.10

Topic 2.2

see topic 1.1

Topic 2.3

```
Your input ->  Which topics are covered in worksheet 5 of COMP 6721?
These are the topics covered in worksheet 5 of COMP 6721:
    topicLabel    resourceURI
-- ------------  --------------------------------------------------------------------------------
 0  XOR           C:/Users/Admin/PycharmProjects/unibot/Data/Lectures/COMP6721/Worksheets/worksheet05.pdf
 1  neuron        C:/Users/Admin/PycharmProjects/unibot/Data/Lectures/COMP6721/Worksheets/worksheet05.pdf
 2  Perceptron    C:/Users/Admin/PycharmProjects/unibot/Data/Lectures/COMP6721/Worksheets/worksheet05.pdf
 3  Delta         C:/Users/Admin/PycharmProjects/unibot/Data/Lectures/COMP6721/Worksheets/worksheet05.pdf
 4  Alison        C:/Users/Admin/PycharmProjects/unibot/Data/Lectures/COMP6721/Worksheets/worksheet05.pdf
```

Topic 2.4

see topic 1.3