



Northeastern University
College of Engineering

Department of Mechanical and Industrial Engineering

IE 3425: Engineering Databases

Final Project Report

Submitted by
Ted Yee

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Lab TAs: Katherine Polum, Johan Cho, Eva Justice

Course Instructor: Ibrahim Zeid

Editor's Note:

A live (static) version of the webpages is available here:

<https://tedyee114.github.io/milesplit/templates/index> and all code is available on GitHub here:
<https://github.com/tedyee114/milesplit.git>.

Due to Flask needing static resources in a direct subfolder called static and GitHub not using relative filepaths, there is no way to have both the web version and the local version correctly run. My solution to this was to add a check as to whether the site was local and then change the references, which works great locally. On the web version though, GitHub's static deployment means that the HTML does not evaluate the variable, and so everything prints twice, with the correct version at the bottom and the forms not being allowed. Please just scroll down to see what it is supposed to look like.

Also, this project is a copy of the real result database website called MileSplit, accessible here and through the webpage <https://wa.milesplit.com/>

Abstract/Overview

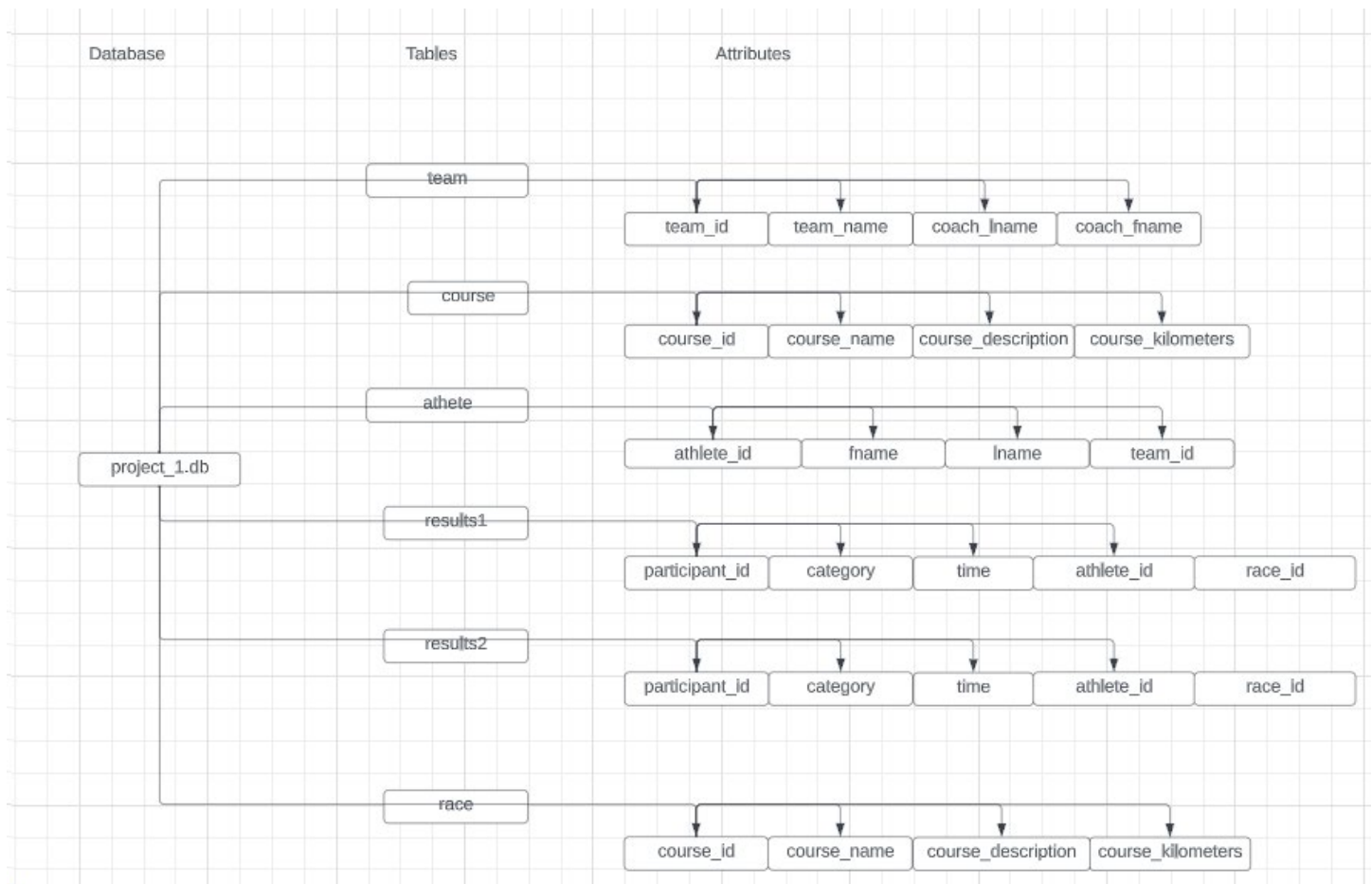
This project is an HTML site which connects via python and SQLite3 to a database file to query and manipulate contained data. The site functions as a knock off the real site MileSplit®, keeping a list of athletes, race results, teams, race schedules, and courses, and makes the information readily available to those using the local version of the site. A web version of the site is available at the link above but is hosted on GitHub and is limited to being static, which prevents queries and evaluation of any sort of variables.

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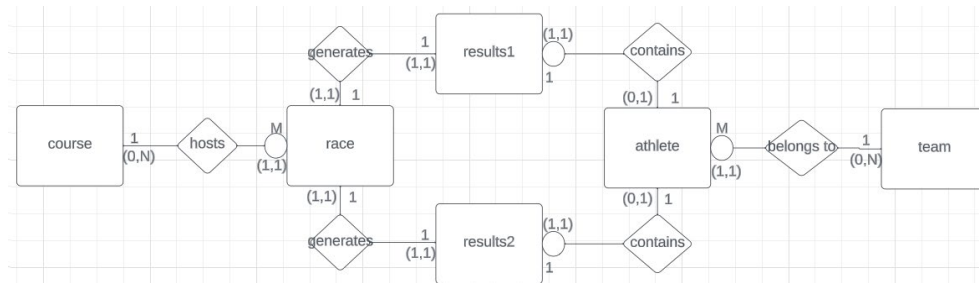
Backend Design

This section is about the design of the database itself. It is designed to be a management system for race results and a way to compile data about results, race schedules, courses, teams, and athletes together. Each of those has a table, as seen below, with an individual table for the results of each race. This way, the database is scalable as new results can be added.

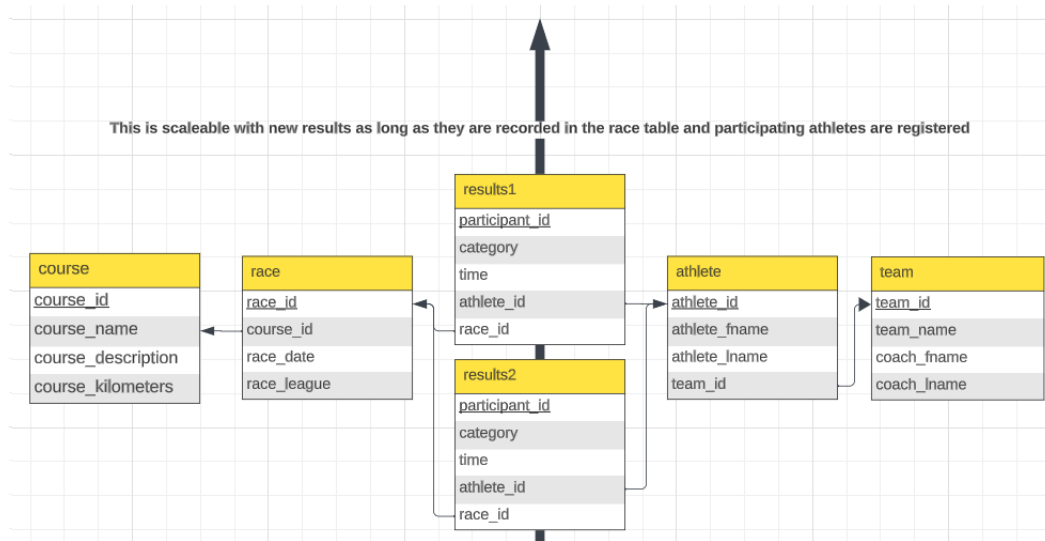


System Data (Meta) Model

The design of the database is fairly simple. The 'race' and 'team' tables are independent entities, which are each referenced by one other table, essentially creating two independent chains. These two chains are connected via foreign key references in every results table. In this example of the database, only 2 sets of results are shown (the apparent ring in the ERD), but as more races are added, there will be many results connecting the two pieces.



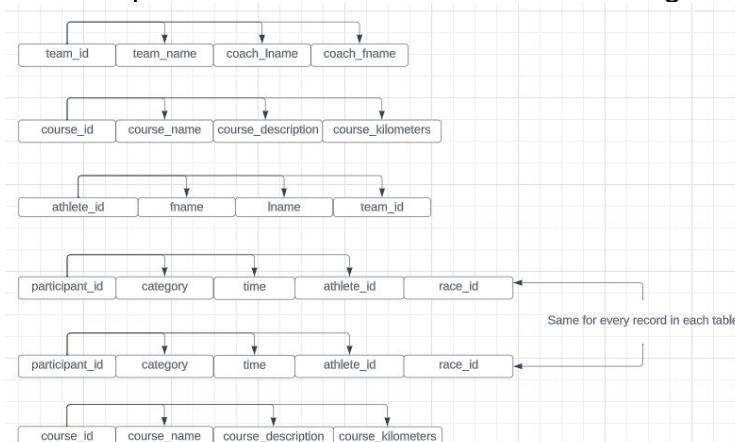
ERD Entity Relationship Diagram



Relational Schema Diagram showing scalable applications

Note that more results can be easily added as long as the race_id and athlete_id are valid. These could be null, and would make the data a little less clean, but that's not preferable. Instead, when new results are added that don't have valid FK's, another script could create new ones, or the database could allow null values.

All tables are normalized because all attributes are dependent only on the foreign keys and there are no transitive or partial dependencies. The only oddity is the race_id attribute in each results table, which is essentially table metadata as every record in a given table is the same as the table's race_id. In this way, data can be queried as a variable rather than calling the table's name directly.



Normalization diagrams for all tables.

The data dictionary for each table and the .schema results showing how it was inputted into SQLite are shown below. This information covers the basics of what type of information every record can be.

```
sqlite> .schema course
CREATE TABLE course (
course_id      integer primary key not null,
course_name    text                  not null,
course_description text              not null,
course_kilometers integer            not null);
sqlite>
sqlite> .schema race
CREATE TABLE race (
race_id        integer primary key not null,
course_id      integer             not null,
race_date      text                 not null,
race_league    text                 not null,
foreign key (course_id) references course(course_id));
sqlite>
sqlite> .schema team
CREATE TABLE team (
team_id        integer primary key not null,
team_name      text                 not null,
coach_fname    text                 not null,
coach_lname    text                 not null);
sqlite>
sqlite> .schema athlete
CREATE TABLE athlete (
athlete_id     integer primary key not null,
athlete_fname  text                 not null,
athlete_lname  text                 not null,
team_id        integer             not null,
foreign key (team_id) references team(team_id));
sqlite>
sqlite> .schema results1
CREATE TABLE results1 (
participant_id integer primary key not null,
category       text                 not null,
time           text                 not null,
athlete_id     integer             not null,
race_id        integer             not null,
foreign key (athlete_id) references athlete(athlete_id),
foreign key (race_id) references race(race_id));
sqlite>
sqlite> .schema results2
CREATE TABLE results2 (
participant_id integer primary key not null,
category       text                 not null,
time           text                 not null,
athlete_id     integer             not null,
race_id        integer             not null,
foreign key (athlete_id) references athlete(athlete_id),
foreign key (race_id) references race(race_id));
```

Database Schema

'course' Table Data Dictionary

Attribute	Description	Data type	Data Format	Sample Value	PK/CPK	FK?	Derived attribute?
course_id	# assigned to identify course	integer	0000	1	PK	No	No
course_name	name of course/location city	short text	abc	Ruka	No	No	No
course_description	terrain/difficulty info	short text	abc	hilly	No	No	No
course_kilometers	course length in kilometers, human inferences sprint vs distance race type	integer	0000	10	No	No	No

'race Table Data Dictionary

Attribute	Description	Data type	Data Format	Sample Value	PK/CPK	FK?	Derived attribute?
race_id	# assigned to identify team	integer	0000	1	PK	No	No
course_id	identifier of course	integer	0000	1	No	FK	No
race_date	when it happened	short text	yyyy-mm-dd	2023-11-24	No	No	No
race_league	race type/class	short text	abc	World Cup	No	No	No

'team' Table Data Dictionary

Attribute	Description	Data type	Data Format	Sample Value	PK/CPK	FK?	Derived attribute?
team_id	# assigned to identify team	integer	0000	1	PK	No	No
team_name	country of team	short text	abc	Germany	No	No	No
coach_fname	name	short text	abc	Bjorn	No	No	No
coach_lname	name	short text	abc	Daehlie	No	No	No

'athlete' Table Data Dictionary

Attribute	Description	Data type	Data Format	Sample Value	PK/CPK?	FK?	Derived attribute?
athlete_id	# assigned to identify athlete	integer	0000	1	PK	No	No
athlete_fname	Name	short text	abc	John	No	No	No
athlete_lname	Name	short text	abc	Smith	No	No	No
team_id	team to which athlete belongs	integer	0000	1	No	Yes	No

'results1' Table Data Dictionary

Attribute	Description	Data type	Data Format	Sample Value	PK/CPK?	FK?	Derived attribute?
participant_id	arbitrary	integer	0000	1	Yes	No	NO
category	men's or women's for scoring	text	abc	mens	No	No	No
time	decimal time taken to complete race or Disqualified, Did not finish, did not start	text	abc	DNF	No	No	No
athlete_id	# assigned to identify athlete	integer	0000	1	No	Yes	No
race_id	connects to race records table	integer	0000	1	No	Yes	No

'results2' Table Data Dictionary

Attribute	Description	Data type	Data Format	Sample Value	PK/CPK?	FK?	Derived attribute?
participant_id	arbitrary	integer	0000	1	Yes	No	NO
category	men's or women's for scoring	text	abc	mens	No	No	No
time	decimal time taken to complete race or Disqualified, Did not finish, did not start	text	abc	DNF	No	No	No
athlete_id	# assigned to identify athlete	integer	0000	1	No	Yes	No
race_id	connects to race records table	integer	0000	1	No	Yes	No

Database Table Records

Here are simply the data points in each table. When this website is used, this information is entered either when users register their team, athletes, or course info, schedule a new race, or upload the results gathered at the timing of the race.

```
sqlite> select * from course;
```

course_id	course_name	course_description	course_kilometers
101	Ruka	hilly	1.5
102	Gallivare	flat laps	23
103	Ostersund	hilly	15
104	Trondheim	flat	10
105	Toblach	flat laps	10
106	Davos	flat	1.3
107	ValdiFiemme	hilly	50
108	Oberhof	hilly laps	5
109	Goms	flat	1.5
110	Canmore	flat	1.5
111	Minneapolis	hilly	50

```
sqlite> select * from race;
```

race_id	course_id	race_date	race_league
1001	102	2023_12_02	World Cup
1002	104	2024_02_14	Tour Du Ski
1003	108	2024_03_04	Eastern Cup
1004	105	2023_12_28	World Cup
1005	107	2023_12_06	World Cup
1006	106	2023_01_20	Tour Du Ski
1007	101	2023_11_24	World Cup
1008	109	2024_02_07	Europe Cup
1009	102	2024_01-14	Birkibeiner
1010	107	2024_01_21	World Cup

```
sqlite> select * from team;
```

team_id	team_name	coach_fname	coach_lname
1	Norway	Bjorn	Daehlie
2	Sweden	Meatball	Chef
3	Finland	Winter	Wars
4	Russia	Vlad	Impaler
5	France	Emmanuel	Macron
6	Italy	Sergio	Mattarella
7	USA	Matt	Whitcomb
8	Canada	Justin	Trudeau
9	Germany	Angela	Merkel
10	Switzerland	Ingemar	Stenmark

```
sqlite> select * from athlete;
```

athlete_id	athlete_fname	athlete_lname	team_id
1	Johannes	Klaebo	1
2	Alexander	Bolshunov	4
3	Jessica	Diggins	7
4	Frida	Karlsson	2
5	Ebba	Anderson	2
6	Richard	Jouve	5
7	Maja	Dahlqvist	2
8	Ben	Ogden	7
9	Federico	Pellegrino	6
10	Didrik	Tonseth	1

```
sqlite> select * from results1;
```

participant_id	category	time	athlete_id	race_id
1	mens	3.01	6	1001
2	mens	3.05	9	1001
3	womens	3.45	4	1001
4	mens	3.47	8	1001
5	mens	3.59	10	1001
6	womens	3.82	5	1001
7	womens	3.9	7	1001
8	womens	4.57	3	1001
9	mens	4.68	1	1001
10	mens	4.71	2	1001

```
sqlite> select * from results2;
```

participant_id	category	time	athlete_id	race_id
1	womens	24.66	3	1002
2	mens	26.2	9	1002
3	mens	26.66	8	1002
4	mens	27.13	10	1002
5	mens	27.67	6	1002
6	womens	DQ	7	1002
7	mens	27.71	1	1002
8	womens	27.75	4	1002
9	mens	27.82	2	1002
10	womens	DNS	5	1002

Examples of SQL Queries Run on the Database

As is the point of a database, the data can be queried in all sorts of ways to provide new ways of viewing information. In this lab, the queries and data management are conducted via a local machine running SQLite3 in a command line. Below are a series of examples of data manipulation on the database conducted in SQLite.

```
sqlite> select * from results1;
```

participant_id	category	time	athlete_id	race_id
1	mens	3.01	6	1001
2	mens	3.05	9	1001
3	womens	3.45	4	1001
4	mens	3.47	8	1001
5	mens	3.59	10	1001
6	womens	3.82	5	1001
7	womens	3.9	7	1001
8	womens	4.57	3	1001
9	mens	4.68	1	1001
10	mens	4.71	2	1001

```
sqlite> select * from results1 order by category;
```

participant_id	category	time	athlete_id	race_id
1	mens	3.01	6	1001
2	mens	3.05	9	1001
4	mens	3.47	8	1001
5	mens	3.59	10	1001
9	mens	4.68	1	1001
10	mens	4.71	2	1001
3	womens	3.45	4	1001
6	womens	3.82	5	1001
7	womens	3.9	7	1001
8	womens	4.57	3	1001

A. 1 sorting query

```
sqlite> select athlete_fname || athlete_lname || '@gmail.com' from athlete as athlete_email;
```

athlete_fname athlete_lname '@gmail.com'
JohannesKlaebo@gmail.com
AlexanderBolshunov@gmail.com
JessicaDiggins@gmail.com
FridaKarlsson@gmail.com
EbbaAnderson@gmail.com
RichardJouve@gmail.com
MajaDahlqvist@gmail.com
BenOgden@gmail.com
FedericoPellegrino@gmail.com
DidrikTonseth@gmail.com

B. 1 formatting and concatenation query

```
select athlete.athlete_fname, athlete_lname, results1.time, results2.time from athlete left join  
results1 on athlete.athlete_id=results1.athlete_id left join results2 on athlete.athlete_id =  
results2.athlete_id;
```

```
sqlite> select athlete.athlete_fname, athlete_lname, results1.time, results2.time  
from athlete left join results1 on athlete.athlete_id=results1.athlete_id left join results2 on athlete.athlete_id =  
results2.athlete_id;
```

athlete_fname	athlete_lname	time	time
Johannes	Klaebo	4.68	27.71
Alexander	Bolshunov	4.71	27.82
Jessica	Diggins	4.57	24.66
Frida	Karlsson	3.45	27.75
Ebba	Anderson	3.82	DNS
Richard	Jouve	3.01	27.67
Maja	Dahlqvist	3.9	DQ
Ben	Ogden	3.47	26.66
Federico	Pellegrino	3.05	26.2
Didrik	Tonseth	3.59	27.13

C. 1 left outer join query D. 1 right outer join query- skipped


```
sqlite> select * from team;
```

team_id	team_name	coach_fname	coach_lname
1	Norway	Bjorn	Daehlie
2	Sweden	Meatball	Chef
3	Finland	Winter	Wars
4	Russia	Vlad	Impaler
5	France	Emmanuel	Macron
6	Italy	Sergio	Mattarella
7	USA	Matt	Whitcomb
8	Canada	Justin	Trudeau
9	Germany	Angela	Merkel
10	Switerland	Ingemar	Stenmark

```
sqlite> update team set coach_lname='Macarooooon' where team_name='France';
...> ;
sqlite> select * from team;
```

team_id	team_name	coach_fname	coach_lname
1	Norway	Bjorn	Daehlie
2	Sweden	Meatball	Chef
3	Finland	Winter	Wars
4	Russia	Vlad	Impaler
5	France	Emmanuel	Macarooooon
6	Italy	Sergio	Mattarella
7	USA	Matt	Whitcomb
8	Canada	Justin	Trudeau
9	Germany	Angela	Merkel
10	Switerland	Ingemar	Stenmark

E. 1 update query

```
sqlite> select * from team;
```

team_id	team_name	coach_fname	coach_lname
1	Norway	Bjorn	Daehlie
2	Sweden	Meatball	Chef
3	Finland	Winter	Wars
4	Russia	Vlad	Impaler
5	France	Emmanuel	Macron
6	Italy	Sergio	Mattarella
7	USA	Matt	Whitcomb
8	Canada	Justin	Trudeau
9	Germany	Angela	Merkel
10	Switerland	Ingemar	Stenmark
11	Australia	Steve	Irwin

```
sqlite> delete from team where coach_fname='Steve';
sqlite> select * from team;
```

team_id	team_name	coach_fname	coach_lname
1	Norway	Bjorn	Daehlie
2	Sweden	Meatball	Chef
3	Finland	Winter	Wars
4	Russia	Vlad	Impaler
5	France	Emmanuel	Macron
6	Italy	Sergio	Mattarella
7	USA	Matt	Whitcomb
8	Canada	Justin	Trudeau
9	Germany	Angela	Merkel
10	Switerland	Ingemar	Stenmark

G. 1 delete query (left)

```
sqlite> select * from team;
```

team_id	team_name	coach_fname	coach_lname
1	Norway	Bjorn	Daehlie
2	Sweden	Meatball	Chef
3	Finland	Winter	Wars
4	Russia	Vlad	Impaler
5	France	Emmanuel	Macron
6	Italy	Sergio	Mattarella
7	USA	Matt	Whitcomb
8	Canada	Justin	Trudeau
9	Germany	Angela	Merkel
10	Switerland	Ingemar	Stenmark

```
sqlite> insert into team (team_id, team_name, coach_fname, coach_lname)
...> values (11, 'Australia', 'Steve', 'Irwin');
sqlite> select * from team;
```

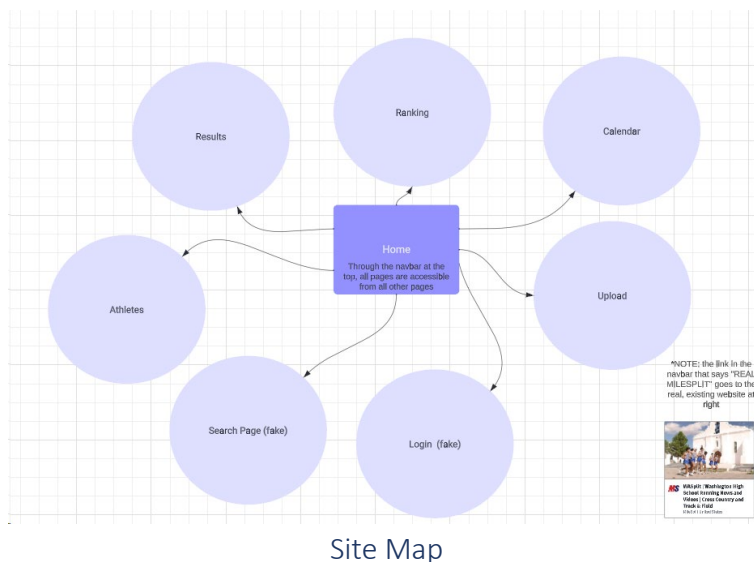
team_id	team_name	coach_fname	coach_lname
1	Norway	Bjorn	Daehlie
2	Sweden	Meatball	Chef
3	Finland	Winter	Wars
4	Russia	Vlad	Impaler
5	France	Emmanuel	Macron
6	Italy	Sergio	Mattarella
7	USA	Matt	Whitcomb
8	Canada	Justin	Trudeau
9	Germany	Angela	Merkel
10	Switerland	Ingemar	Stenmark
11	Australia	Steve	Irwin

F. 1 insert query (right)

Front End Design

After creating and practicing manipulating the data in the database, it can be connected to a series of simple HTML webpages via python accessing a terminal and running SQLite3 on a local machine. However, this means that in order to work, the HTML sites must be accessed through local ports only. While a live version of the HTML pages is available as a statically hosted GitHub Pages deployment [here](#), they are inoperable as they are not connected to a python script, a command line, SQLite3, or the database.

The website designed to access this data is modeled as a copy of the real website MileSplit. As such, the pages are set up as in the below site map, with the home page being the initial landing page. All pages have a navigation bar at the top that allows them to access all other pages though.



As in the Site skeleton below, most pages serve to access data in a unique way through python.

Site Skeleton

- Home page
 - Static images
- Results
 - **Report** of data from specified race result table
 - **Plot** (bar graph) of race distances
- Rankings
 - **Extracts** athlete total place
 - **Plot** of times
- Calendar
 - **Extracts** all records from the race table (i.e., shows all listed races)
- Athletes
 - **Report** of athlete's times from all available race results
- Upload
 - **Adds** new records to race results
 - **Adds** new athletes
- Search & Login
 - Static page saying that this page has not yet been built

Code

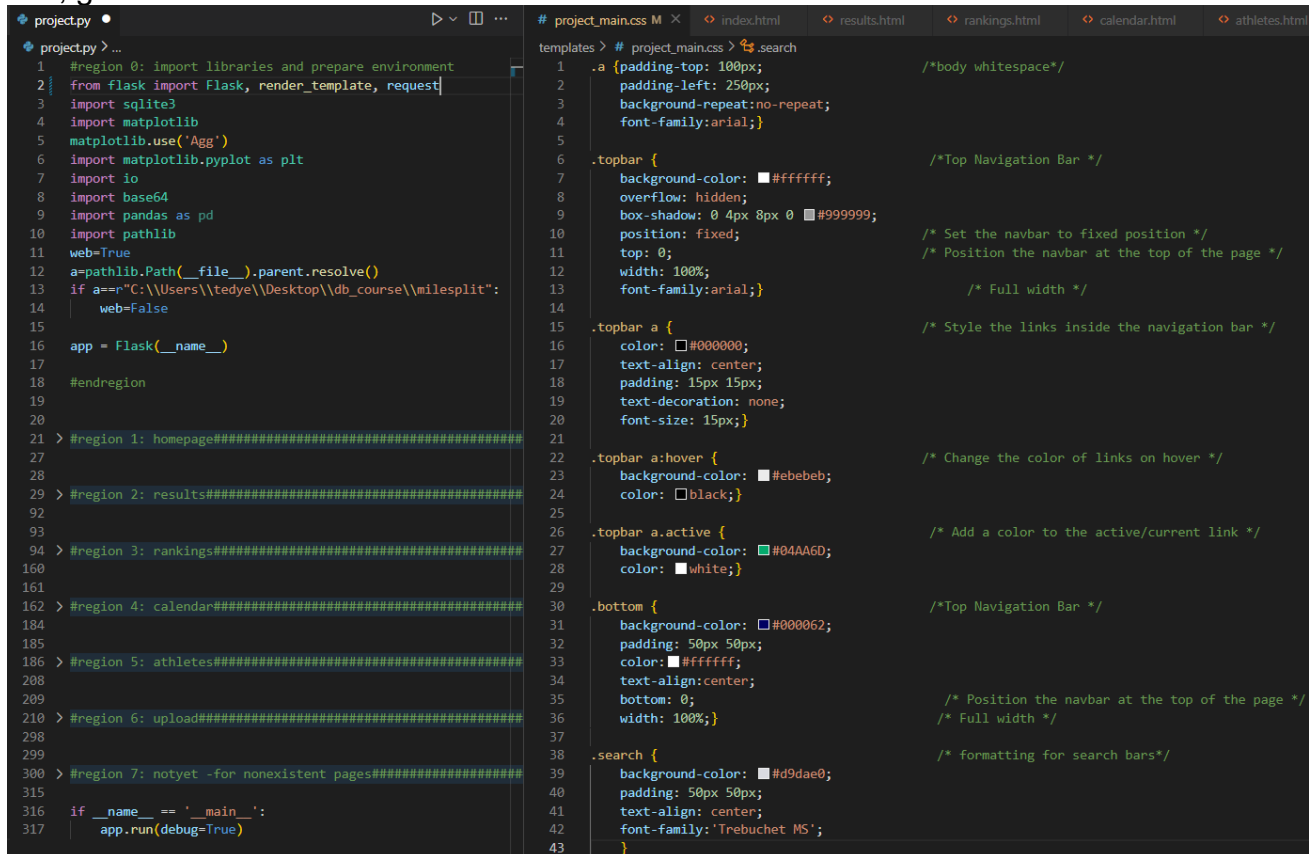
Once again, it is recommended that the code be viewed on GitHub here:

<https://github.com/tesyee114/milesplit.git>

And that the live (but static) webpage be viewed here:

<https://tesyee114.github.io/milesplit/templates/index>

Also, please note that in order to make the code run both locally and on GitHub some syntax had to change, such as `{{URLfor'page'}}` just becoming `'page'`. There is a lot of redundant code that depends on whether or not the HTML site is being viewed locally or on GitHub, necessary to correct filepaths to static image content. To avoid redundancies caused by that and by the repeated headers and footers, they will only be shown once and will be collapsed in the screenshots for brevity. To see the full code, go to the GitHub above.



The screenshot displays a code editor with two panels. The left panel shows a Python file named `project.py` with line numbers 1 through 317. The code includes imports for Flask, SQLite3, Matplotlib, and other libraries, followed by Flask application setup and route definitions for various pages like homepage, results, rankings, calendar, athletes, and upload. The right panel shows a CSS file named `project_main.css` with line numbers 1 through 43. The CSS defines styles for the body, navigation bar (topbar), and search bar, including colors, padding, and font families. The editor interface includes a file explorer on the left and a tab bar at the top showing multiple open files.

```
project.py
1 #region 0: import libraries and prepare environment
2 from flask import Flask, render_template, request
3 import sqlite3
4 import matplotlib
5 matplotlib.use('Agg')
6 import matplotlib.pyplot as plt
7 import io
8 import base64
9 import pandas as pd
10 import pathlib
11 web=True
12 a=pathlib.Path(__file__).parent.resolve()
13 if a=="C:\\Users\\tesyee\\Desktop\\db_course\\milesplit":
14     web=False
15
16 app = Flask(__name__)
17
18 #endregion
19
20 > #region 1: homepage#####
21
22 > #region 2: results#####
23
24 > #region 3: rankings#####
25
26 > #region 4: calendar#####
27
28 > #region 5: athletes#####
29
30 > #region 6: upload#####
31
32 > #region 7: notyet -for nonexistent pages#####
33
34 if __name__ == '__main__':
35     app.run(debug=True)
```

```
# project_main.css
1 .a {padding-top: 100px; /*body whitespace*/
2 padding-left: 250px;
3 background-repeat:no-repeat;
4 font-family:arial;}
5
6 .topbar { /*Top Navigation Bar */
7 background-color: #ffffff;
8 overflow: hidden;
9 box-shadow: 0 4px 8px 0 #999999;
10 position: fixed; /* Set the navbar to fixed position */
11 top: 0; /* Position the navbar at the top of the page */
12 width: 100%;
13 font-family:arial;} /* Full width */
14
15 .topbar a { /* Style the links inside the navigation bar */
16 color: #000000;
17 text-align: center;
18 padding: 15px 15px;
19 text-decoration: none;
20 font-size: 15px;}
21
22 .topbar a:hover { /* Change the color of links on hover */
23 background-color: #ebebcb;
24 color: black;}
25
26 .topbar a.active { /* Add a color to the active/current link */
27 background-color: #04AA6D;
28 color: white;}
29
30 .bottom { /*Top Navigation Bar */
31 background-color: #000062;
32 padding: 50px 50px;
33 color:#ffffff;
34 text-align:center;
35 bottom: 0; /* Position the navbar at the top of the page */
36 width: 100%; /* Full width */
37
38 .search { /* formatting for search bars*/
39 background-color: #d9dae0;
40 padding: 50px 50px;
41 text-align: center;
42 font-family:'Trebuchet MS';
43 }
```

Overview of Python Code and CSS File

Homepage Python Script, HTML, rendered webpage

```
project.py M X
1 #region 0: import libraries and prepare environment
2 from flask import Flask, render_template, request, url_for
3 import sqlite3
4 import matplotlib
5 matplotlib.use('Agg')
6 import matplotlib.pyplot as plt
7 import io
8 import base64
9 import pandas as pd
10 import pathlib
11 web=True
12 a=pathlib.Path(__file__).parent.resolve()
13 if a=="C:\\Users\\tedye\\Desktop\\db_course\\milesplit":
14     web=False
15
16 app = Flask(__name__)
17
18 #endregion
19
20
21 #region 1: homepage#####
22 @app.route('/')
23 @app.route('/index')
24 def index():
25     return render_template('index.html')
26 #endregion
27
28
29 #region 2: results#####
30
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```

Results Python Script, HTML, rendered webpage

```

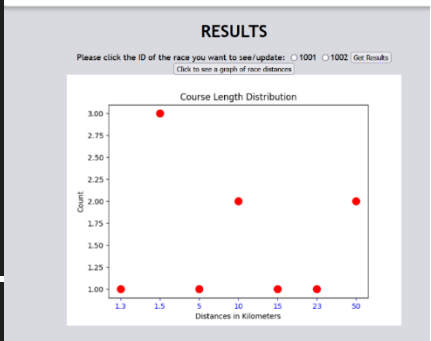
templates > <> results.html
1  <!DOCTYPE html>
2  <html>
3  {% if web==FALSE %}
4  >    <head>...
8    </head>
9    <br><br><br><br><br><br>
10 >    <div class="topbar">                                <!--Top Navigation Bar-->...
20    </div>
21
22    <div class="search">                                <!--This div uses style a to adds outer padding to everything-->
23    <body style="background-color:#ebebeb">              <!--This div adds the background because 'search' is not cooperating with me-->
24    <h1>RESULTS</h1>
25
26    <form method="POST" action='results'>
27      <label>Please click the ID of the race you want to see/update:</label>      <!-- Just get results-->
28      <input type="radio" name="race_id" value='1001'/>1001
29      <input type="radio" name="race_id" value='1002'/>1002
30      <input type="submit" value="Get Results">
31    </form>
32
33    <form method="POST" action='distplot'>
34      <input type="submit" name="distplot" value="Click to see a graph of race distances">  <!--Make a plot of race distances-->
35    </form>
36
37    {% if output %}
38      <table>
39        <tr>
40          <td colspan="1" rowspan="1" align='center'><b>Participant ID, assigned randomly at the race<b></td>
41          <td colspan="1" rowspan="1" align='center'><b>Race Category<b></td>
42          <td colspan="1" rowspan="1" align='center'><b>Time<b></td>
43          <td colspan="1" rowspan="1" align='center'><b>Athlete ID<b></td>
44          <td colspan="1" rowspan="1" align='center'><b>Race ID<b></td>
45          <td colspan="1" rowspan="1" align='center'><b>Place<b></td>
46        </tr>
47        <ul>
48          {% for i in output %}
49            <tr>
50              <td colspan="1" rowspan="1" align='center'>{{i[0]}}</td>
51              <td colspan="1" rowspan="1" align='center'>{{i[1]}}</td>
52              <td colspan="1" rowspan="1" align='center'>{{i[2]}}</td>
53              <td colspan="1" rowspan="1" align='center'>{{i[3]}}</td>
54              <td colspan="1" rowspan="1" align='center'>{{i[4]}}</td>
55              <td colspan="1" rowspan="1" align='center'>{{i[5]}}</td>
56              <td colspan="1" rowspan="1" align='center'>{{i[6]}}</td>
57            </tr>
58          {% endfor %}
59        </ul>
60      </table>
61    {% endif %}
62
63    {% if chart_image %}
64      
65    {% endif %}
66  </body>
67 </div>
68
69  <br><br><br><br><br><br><br><br><br><br><br><br><br><br><br>
70
71 >    <div class="bottom">                                <!--Top Navigation Bar-->...
80    </div>
81 >    {% else %}...
159 </endif%>
160 </html>

```

```

project.py
project.py > ...
21 > #region 1: homepage#####
27
28
29 #region 2: results#####
30 @app.route('/results', methods=['GET', 'POST'])
31 def results():
32     if request.method == 'POST':
33         if request.form['race_id']:
34             race_id=request.form['race_id']
35             conn = sqlite3.connect('C:/Users/tedye/Desktop/db_course/project_1.db')
36             cursor = conn.cursor() # Create a cursor object to execute SQL queries
37             if race_id=="1001":
38                 cursor.execute("SELECT * from results1")
39             elif race_id=="1002":
40                 cursor.execute("SELECT * from results2")
41
42             output = cursor.fetchall()
43             cursor.close()
44             conn.close()
45             return render_template('results.html', output=output)
46         else:
47             return render_template('results.html', message='Please select a race')
48     else:
49         return render_template('results.html')
50
51 @app.route('/distplot', methods=['GET', 'POST'])
52 def distplot():
53     if request.method == 'POST':
54         conn = sqlite3.connect('C:/Users/tedye/Desktop/db_course/project_1.db')
55         cursor = conn.cursor() # Create a cursor object to execute SQL queries
56         cursor.execute("SELECT course_kilometers, COUNT(*) from course GROUP BY course_kilometers;")
57         rows = cursor.fetchall()
58         cursor.close()
59         conn.close()
60
61         distances = []
62         counts = []
63
64         plt.clf()
65
66         for row in rows:
67             distances.append(row[0])
68             counts.append(row[1])
69         x = list(range(len(distances))) # Create an array of indices for the x-axis
70
71         plt.scatter(x, counts, color='red', s=100)
72
73         plt.xlabel('Distances in Kilometers') # Adding labels and title
74         plt.ylabel('Count')
75         plt.title('Course Length Distribution')
76
77         plt.xticks(x, distances) # Set the x-axis tick positions and labels
78         plt.tick_params(axis='x', colors='blue')
79
80         buffer = io.BytesIO() # Save the chart image to a buffer
81         plt.savefig(buffer, format='png')
82         buffer.seek(0)
83
84         image_base64 = base64.b64encode(buffer.getvalue()).decode() # Convert the image buffer to base64 string
85
86         chart_image = f"data:image/png;base64,{image_base64}" # Generate the chart image URL
87
88         return render_template('results.html', chart_image=chart_image)
89     else:
90         return render_template('results.html')
91 #endregion
92

```



```
sqlite> select * from results1;
```

participant_id	category	time	athlete_id	race_id
1	mens	3.01	6	1001
2	mens	3.05	9	1001
3	womens	3.45	4	1001
4	mens	3.47	8	1001
5	mens	3.59	10	1001
6	womens	3.82	5	1001
7	womens	3.9	7	1001
8	womens	4.57	3	1001
9	mens	4.68	1	1001
10	mens	4.71	2	1001

MileSplit SNOW RESULTS RANKINGS CALENDAR ATHLETES UPLOAD REAL MILESPIT

RESULTS

Please click the ID of the race you want to see/update: ☐ 1001 ☐ 1002 [Get Results](#)

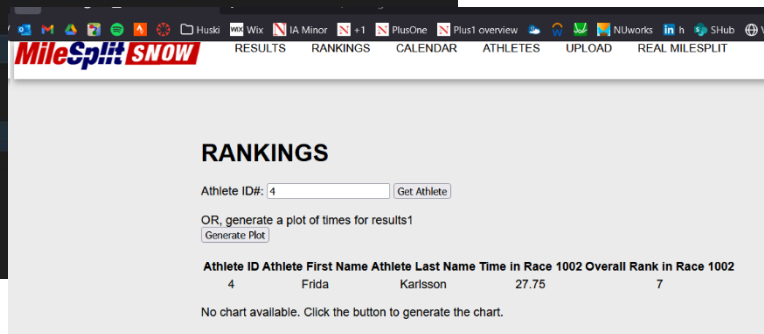
[Click to see a graph of race distances](#)

Participant ID, assigned randomly at the race	Race Category	Time	Athlete ID	Race ID	Place
1	mens	3.01	6	1001	
2	mens	3.05	9	1001	
3	womens	3.45	4	1001	
4	mens	3.47	8	1001	
5	mens	3.59	10	1001	
6	womens	3.82	5	1001	
7	womens	3.9	7	1001	
8	womens	4.57	3	1001	
9	mens	4.68	1	1001	
10	mens	4.71	2	1001	

project_main.css M index.html results.html M rankings.html calendar.html athletes.html

```
sqlite> select * from results1;
```

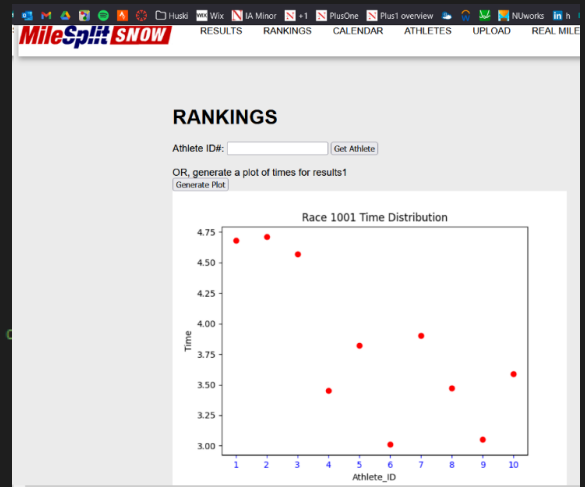
participant_id	category	time	athlete_id	race_id
1	mens	3.01	6	1001
2	mens	3.05	9	1001
3	womens	3.45	4	1001
4	mens	3.47	8	1001
5	mens	3.59	10	1001
6	womens	3.82	5	1001
7	womens	3.9	7	1001
8	womens	4.57	3	1001
9	mens	4.68	1	1001
10	mens	4.71	2	1001




```

94 #region 3: rankings#####
95 @app.route('/rankings', methods=['GET', 'POST'])
96 def rankings():
97     if request.method == 'POST' and request.form ['athlete_id'] is not None:
98         athlete_id=request.form ['athlete_id']
99         print ('ath',athlete_id)
100         conn = sqlite3.connect('C:/Users/tedye/Desktop/db_course/project_1.db')
101         cursor = conn.cursor() # Create a cursor object to execute SQL queries
102         cursor.execute("SELECT * from (select athlete.athlete_id, athlete_fname, athlete_lname, time,\
103         rank () over (order by time) from athlete left join\
104         results2 on athlete.athlete_id=results2.athlete_id where athlete_id=?, (athlete_id))")
105         output = cursor.fetchall()
106         cursor.close()
107         conn.close()
108
109         if not output:
110             message = 'No athlete found'
111             return render_template('rankings.html', message=message)
112         else:
113             return render_template('rankings.html', output=output)
114
115     else:
116         return render_template('rankings.html')
117
118 @app.route('/timeplot', methods=['GET', 'POST'])
119 def timeplot():
120     if request.method == 'POST' and request.form ['timeplot'] is not None:
121         print("timeplot", request.form ['timeplot'])
122         conn = sqlite3.connect('C:/Users/tedye/Desktop/db_course/project_1.db')
123         cursor = conn.cursor() # Create a cursor object to execute SQL queries
124         cursor.execute("SELECT athlete_id, time from results1 order by athlete_id")
125         rows = cursor.fetchall()
126         cursor.close()
127         conn.close()
128
129         athlete_id = []
130         time = []
131
132         plt.clf()
133
134         for i in rows:
135             athlete_id.append(i[0])
136             time.append(float(i[1]))
137         x = list(range(len(athlete_id))) # Create an array of x-axis values
138
139         plt.scatter(x, time, color='red')
140
141         plt.xlabel('Athlete_ID')
142         plt.ylabel('Time')
143         plt.title('Race 1001 Time Distribution')
144
145         plt.xticks(x, athlete_id) # Set the x-axis tick positions and labels
146         plt.tick_params(axis='x', colors='blue')
147
148         buffer = io.BytesIO() # Save the chart image to a buffer
149         plt.savefig(buffer, format='png')
150         buffer.seek(0)
151
152         image_base64 = base64.b64encode(buffer.getvalue()).decode() # Convert the image buffer to base64 string
153
154         chart = f"data:image/png;base64,{image_base64}" # Generate the chart image URL
155
156         return render_template('rankings.html', chart_image=chart)
157
158     else:
159         return render_template('rankings.html')
160 #endregion

```



CALENDAR Python Script, HTML, rendered webpage

```
# project_main.css M      # index.html      < results.html M      < rankings.html M      calendar.html •      < athletes.html      < upload.html      < notyet.html      < db_lab_10_C

templates > <> calendar.html
1 <!DOCTYPE html>
2 <html>
3 {% if web==FALSE %}
4 <head> ...
8 </head>
9 <div class="topbar">                                <!--Top Navigation Bar--> ...
19 </div>
20
21 <div class="a">                                        <!--This div uses style a to adds outer padding to everything-->
22   <body style="background-color:#ebebeb">
23     <h1>CALENDAR</h1>
24     <i style="font-size:50">MileSplit Results</i>
25     <br>
26     <h2>Recent Results</h2>
27     <form method='POST' action='calendar'>
28       <input type="submit" value='Click to Query Recent Results'/>
29     </form>
30     {% if output %}
31     <table>
32       <tr>
33         <td colspan="1" rowspan="1.9" align='center' style="background-color:#555555; color:#ffffff; font-family:arial"><b>Race ID<b></td>
34         <td colspan="1" rowspan="1.9" align='center' style="background-color:#555555; color:#ffffff; font-family:arial"><b>Course ID<b></td>
35         <td colspan="1" rowspan="1.9" align='center' style="background-color:#555555; color:#ffffff; font-family:arial"><b>Race Date<b></td>
36         <td colspan="1" rowspan="1.9" align='center' style="background-color:#555555; color:#ffffff; font-family:arial"><b>Race League<b></td>
37       </tr>
38       <ul>
39         {% for i in output %}
40         <tr>
41           <td colspan="1" rowspan="1" align='center'>{{i[0]}}</td>
42           <td colspan="1" rowspan="1" align='center'>{{i[1]}}</td>
43           <td colspan="1" rowspan="1" align='center'>{{i[2]}}</td>
44           <td colspan="1" rowspan="1" align='center'>{{i[3]}} {{i[4]}}</td>
45         </tr>
46         {% endfor %}
47       </ul>
48     </table>
49     {% endif %}
50
51     {% if message %}
52     <h2>{{message}}</h2>
53     {% endif %}
54     <br><br><br><br>
55     <h2>Upcoming Events</h2>
56     
57
58     {% if chart_image %}
59     
60     {% endif %}
61   </body>
62 </div>
63 <br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br>
64 <div class="bottom">                                <!--Top Navigation Bar--> ...
73 </div>
74
75 > {%else%} ...
148 {%endif%}
```

```
# 163 #region 4: calendar#####
164 @app.route('/calendar', methods=['GET', 'POST'])
165 def calendar():
166     if request.method == 'POST':
167         # Establish a connection to the SQLite database
168         conn = sqlite3.connect('C:/Users/tedye/Desktop/db_course/project_1.db')
169         cursor = conn.cursor() # Create a cursor object to execute SQL queries
170         cursor.execute("SELECT * from race ORDER BY race_date")
171         output = cursor.fetchall()
172         cursor.close()
173         conn.close()
174
175         print(output)
176
177         if not output:
178             message = 'No Races found'
179             return render_template('calendar.html', message=message)
180         else:
181             return render_template('calendar.html', output=output)
182     else:
183         return render_template('calendar.html')
184 #endregion
```

MileSplitSNOW

RESULTS RANKINGS CALENDAR ATHLETES UPLOAD REAL MILESPLOT

CALENDAR

Recent Results

Click to Query Recent Results

Upcoming Events

November 2023

Today Day Week Month ...

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
11/5	6	7	8	9	10	11

sqlite> select * from race
...> ;

race_id	course_id	race_date	race_league
1001	102	2023_12_02	World Cup
1002	104	2024_02_14	Tour Du Ski
1003	108	2024_03_04	Eastern Cup
1004	105	2023_12_28	World Cup
1005	107	2023_12_06	World Cup
1006	106	2023_01_20	Tour Du Ski
1007	101	2023_11_24	World Cup
1008	109	2024_02_07	Europe Cup
1009	102	2024_01-14	Birkibeiner
1010	107	2024_01_21	World Cup

MileSplitSNOW

RESULTS RANKINGS CALENDAR ATHLETES

CALENDAR

Recent Results

Click to Query Recent Results

Race ID	Course ID	Race Date	Race League
1006	106	2023_01_20	Tour Du Ski
1007	101	2023_11_24	World Cup
1001	102	2023_12_02	World Cup
1005	107	2023_12_06	World Cup
1004	105	2023_12_28	World Cup
1009	102	2024_01-14	Birkibeiner
1010	107	2024_01_21	World Cup
1008	109	2024_02_07	Europe Cup
1002	104	2024_02_14	Tour Du Ski
1003	108	2024_03_04	Eastern Cup

ATHLETES Python Script, HTML, rendered webpage

```

index.html
rankings.html M
calendar.html M
athletes.html
upload.html

templates > athletes.html
1 <!DOCTYPE html>
2 <html>
3 {% if web==FALSE %}
4 <head>...
8 </head>
9
10 <div class="topbar"> <!--Top Navigation Bar-->...
20 </div>
21 <br><br><br><br><br><br><br><br><br>
22
23 <div class="search">
24 <body style="background-color:#ebebeb">
25 <h1>ATHLETES</h1>
26
27 <form method="POST" action='athletes'>
28 <label>Athlete ID#:</label>
29 <input type="text" name="athlete_id">
30 <input type="submit" name="submit" value="Submit Application" class="submit" />
31 </form>
32
33 {% if output %}
34 <table>
35 <tr>
36 <td colspan="1" rowspan="1" align='center'><b>Athlete ID<b></td>
37 <td colspan="1" rowspan="1" align='center'><b>Athlete First Name<b></td>
38 <td colspan="1" rowspan="1" align='center'><b>Athlete Last Name<b></td>
39 <td colspan="1" rowspan="1" align='center'><b>Race #<b></td>
40 <td colspan="1" rowspan="1" align='center'><b>Time<b></td>
41 <td colspan="1" rowspan="1" align='center'><b>Race #<b></td>
42 <td colspan="1" rowspan="1" align='center'><b>Time<b></td>
43 </tr>
44 <ul>
45 {% for i in output %}
46 <tr>
47 <td colspan="1" rowspan="1" align='center'>{{i[0]}}</td>
48 <td colspan="1" rowspan="1" align='center'>{{i[1]}}</td>
49 <td colspan="1" rowspan="1" align='center'>{{i[2]}}</td>
50 <td colspan="1" rowspan="1" align='center'>{{i[3]}}</td>
51 <td colspan="1" rowspan="1" align='center'>{{i[4]}}</td>
52 <td colspan="1" rowspan="1" align='center'>{{i[5]}}</td>
53 <td colspan="1" rowspan="1" align='center'>{{i[6]}}</td>
54 </tr>
55 {% endfor %}
56 </ul>
57 </table>
58 {% endif %}
59
60 {% if message %}
61 <br>
62 <h2>{{message}}</h2>
63 {% endif %}
64 </body>
65 </div>
66 <br><br><br><br><br><br><br><br><br><br><br><br><br><br>
67
68 <div class="bottom"> <!--Footer-->...
69 </div>
70
71 {% else %}...
156 {% endif %}
157 </html>

```

```

187 #region 5: athletes#####
188 @app.route('/athletes', methods=['GET', 'POST'])
189 def athletes():
190     if request.method == 'POST':
191         athlete_id = request.form ['athlete_id']
192
193         if athlete_id:
194             # Establish a connection to the SQLite database
195             conn = sqlite3.connect('C:/Users/tedye/Desktop/db_course/project_1.db')
196             cursor = conn.cursor() # Create a cursor object to execute SQL queries
197             cursor.execute("SELECT * from (select athlete.athlete_id, athlete_fname, athlete_lname, results1.race_id,\
198                 results1.time, results2.race_id, results2.time from athlete left join results1 on athlete.athlete_id=results1.athlete_id\
199                 left join results2 on athlete.athlete_id = results2.athlete_id) where athlete_id=?", (athlete_id,))
200             output = cursor.fetchall()
201             cursor.close()
202             conn.close()
203             return render_template('athletes.html', output=output)
204         else:
205             return render_template('athletes.html', message='No Athlete ID Entered. Please enter one.')
206     else:
207         return render_template('athletes.html')
208 #endregion
209

```

sqlite> select * from athlete;

athlete_id	athlete_fname	athlete_lname	team_id
1	Johannes	Klaebo	1
2	Alexander	Bolshunov	4
3	Jessica	Diggins	7
4	Frida	Karlsson	2
5	Ebba	Anderson	2
6	Richard	Jouve	5
7	Maja	Dahlqvist	2
8	Ben	Ogden	7
9	Federico	Pellegrino	6
10	Didrik	Tonseth	1
11	r	r	5

sqlite> select * from results1
...> ;

participant_id	category	time	athlete_id	race_id
1	mens	3.01	6	1001
2	mens	3.05	9	1001
3	womens	3.45	4	1001
4	mens	3.47	8	1001
5	mens	3.59	10	1001
6	womens	3.82	5	1001
7	womens	3.9	7	1001
8	womens	4.57	3	1001
9	mens	4.68	1	1001
10	mens	4.71	2	1001

sqlite> select * from results2
...> ;

participant_id	category	time	athlete_id	race_id
1	womens	24.66	3	1002
2	mens	26.2	9	1002
3	mens	26.66	8	1002
4	mens	27.13	10	1002
5	mens	27.67	6	1002
6	womens	DQ	7	1002
7	mens	27.71	1	1002
8	womens	27.75	4	1002
9	mens	27.82	2	1002
10	womens	DNS	5	1002

ATHLETES

Athlete ID#:

Athlete ID	Athlete First Name	Athlete Last Name	Race #	Time	Race #	Time
5	Ebba	Anderson	1001	3.82	1002	DNS

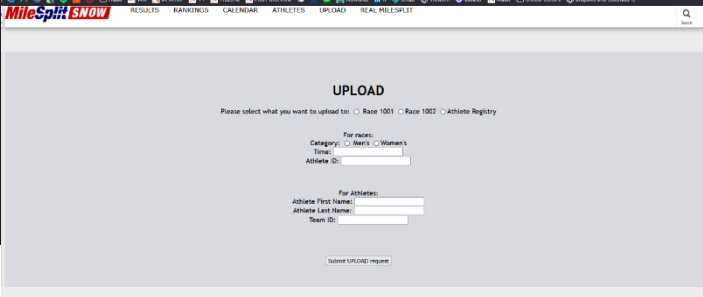
©2023 Ted Yee. Don't Contact Us. Privacy is fake. Terms of Misuse. Your Personal Information Will be Sold Anyway.

UPLOAD Python Script, HTML, rendered webpage

```

211 #region 6: upload=====
212 @app.route('/upload', methods=['GET', 'POST'])
213 def upload():
214     if request.method == 'POST':
215         tochange=request.form ['tochange']
216         print(tochange)
217         if tochange=='1001':
218             category=request.form ['category']
219             time=request.form ['time']
220             athlete_id=request.form ['athlete_id']
221             conn = sqlite3.connect('C:/Users/tedye/Desktop/db_course/project_1.db')
222             cursor = conn.cursor() # Create a cursor object to execute SQL queries
223             cursor.execute("SELECT MAX(participant_id) FROM results1")
224             max_participant_id = cursor.fetchone() # returns one-element tuple (id,)
225             max_participant_id = max_participant_id[0] # extract id as digits
226             if max_participant_id is None:
227                 participant_id = 1
228             else:
229                 participant_id = max_participant_id + 1
230
231             cursor.execute("insert into results1 (participant_id, category, time, athlete_id,\
232                 race_id) values(?, ?, ?, ?, ?)", (participant_id,category,time,athlete_id,1001))
233             cursor.execute("SELECT * from results1")
234             output = cursor.fetchall()
235             cursor.close()
236             conn.close()
237
238             if not output:
239                 message = 'No Races found'
240                 return render_template('upload.html', message=message)
241             else:
242                 return render_template('upload.html', output=output)
243
244         elif tochange=='1002':
245             category=request.form ['category']
246             time=request.form ['time']
247             athlete_id=request.form ['athlete_id']
248             conn = sqlite3.connect('C:/Users/tedye/Desktop/db_course/project_1.db')
249             cursor = conn.cursor() # Create a cursor object to execute SQL queries
250             cursor.execute("SELECT MAX(participant_id) FROM results2")
251             max_participant_id = cursor.fetchone() # returns one-element tuple (id,)
252             max_participant_id = max_participant_id[0] # extract id as digits
253             if max_participant_id is None:
254                 participant_id = 1
255             else:
256                 participant_id = max_participant_id + 1
257
258             cursor.execute("insert into results2 (participant_id, category, time, athlete_id,\
259                 race_id) values(?, ?, ?, ?, ?)", (participant_id,category,time,athlete_id,1002))
260             cursor.execute("SELECT * from results2")
261             output = cursor.fetchall()
262             cursor.close()
263             conn.close()
264
265             if not output:
266                 message = 'No Races found'
267                 return render_template('upload.html', message=message)
268             else:
269                 return render_template('upload.html', output=output)
270
271         elif tochange=='athlete':
272             athlete_fname=request.form ['athlete_fname']
273             athlete_lname=request.form ['athlete_lname']
274             team_id=request.form ['team_id']
275             conn = sqlite3.connect('C:/Users/tedye/Desktop/db_course/project_1.db')
276             cursor = conn.cursor() # Create a cursor object to execute SQL queries
277             cursor.execute("SELECT MAX(athlete_id) FROM athlete")
278             max_athlete_id = cursor.fetchone() # returns one-element tuple (id,)
279             max_athlete_id = max_athlete_id[0] # extract id as digits
280             if max_athlete_id is None:
281                 athlete_id = 1
282             else:
283                 athlete_id = max_athlete_id + 1
284
285             cursor.execute("insert into athlete (athlete_id, athlete_fname, athlete_lname,\
286                 team_id) values(?, ?, ?, ?)", (athlete_id,athlete_fname,athlete_lname,team_id,))
287             cursor.execute("SELECT * from athlete")
288             conn.commit()
289             output = cursor.fetchall()
290             cursor.close()
291             conn.close()
292             print (output)
293             if not output:
294                 message = 'No Races found'
295                 return render_template('upload.html', message=message)
296             else:
297                 return render_template('upload.html', output=output)
298
299         else:
300             return render_template('upload.html')
301 #endregion

```

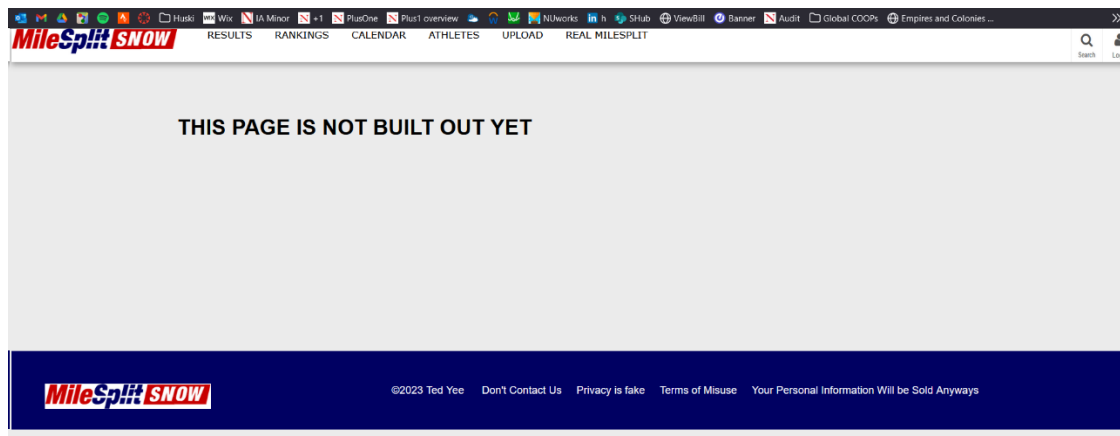


The screenshot shows the MileSplit SNOW website interface. At the top, there's a navigation bar with links: RESULTS, RANKINGS, CALENDAR, ATHLETES, UPLOAD, and REAL TIME/SPLIT. The main content area is titled "UPLOAD" and includes a sub-header "Please select what you want to upload for: ☐ Race 1001 ☐ Race 1002 ☐ Athlete Registry". Below this, there are two sections for data entry. The first section, "For Races:", includes fields for "Category:" (with a dropdown menu), "Time:" (with a text input), and "Athlete ID:" (with a text input). The second section, "For Athletes:", includes fields for "Athlete First Name:", "Athlete Last Name:", and "Team ID:". At the bottom of the form, there is a "Submit UPLOAD request" button.


```

project.py M •
project.py > notyet
1 > #region 0: import libraries and prepare environment
19
20
21 > #region 1: homepage#####
27
28
29 > #region 2: results#####
92
93
94 > #region 3: rankings#####
161
162
163 > #region 4: calendar#####
185
186
187 > #region 5: athletes#####
209
210
211 > #region 6: upload#####
304
305
306 #region 7: notyet -for nonexistent pages#####
307 @app.route('/notyet', methods=['GET', 'POST'])
308 def notyet():
309     return render_template('notyet.html')
310 #endregion
311
312 if __name__ == '__main__':
313     app.run(debug=True)

```



Conclusion and Going Forward

This project is complete but is definitely capable of being expanded much further. From simply making the HTML look nicer to adding other SQL queries, there is a lot to do that could make it a usable, practical site. The biggest change that could be made, however, would be to make the site hosted on a more robust server that allows the python commands to connect to SQL and manipulate and query the data. Then it would be a truly live database site that could live up to its ability to handle larger amounts of data.

Features that I wanted to include, but ran out of time for, were methods to upload new results in their entirety or time races directly on the website and a general search feature that would allow querying of all data. The first would be easily completed via SQL "CREATE TABLE", then ".import" or use python to create a stopwatch and create records from it. The search feature could either provide a way to query all information in a given table using SQL "SELECT * from ____" or a real search could be conducted with a search field that controls a "SELECT * from _ WHERE ____=input".