Software Engineer Assessment

Out of respect for your time, spend a maximum of 3 hours on this assessment. Incomplete solutions are acceptable if you run out of time. Your thought process when problem-solving and writing software is more important than any specific solution.

You may organize your solutions in any way that makes sense to you. Simply ensure that each question can be tested independently of the others. Feel free to use any programming language you wish.

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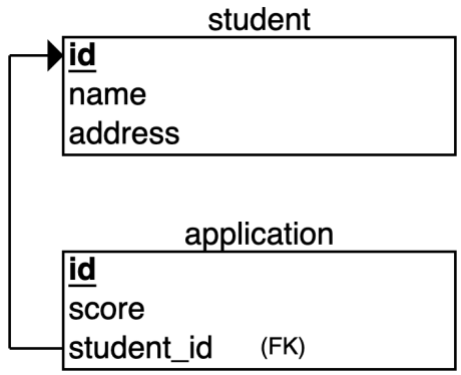
1. Given two database tables:



Write a SQL query to list the student id, name, and the number of applications each student has. Report 0 for students with no applications. List students first by number of applications, then alphabetically by name.

If using PostgreSQL, the following SQL should create these tables for you:

```
CREATE TABLE student
(id INTEGER PRIMARY KEY, name TEXT, address TEXT);
CREATE TABLE application
(id INTEGER PRIMARY KEY, student_id INTEGER REFERENCES student (id), score INTEGER);
```

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2. Given a raw string of basic html with no formatting such as:
`<html><body><div><a></a></div></body></html>`

Without using a parsing library, write a program to parse the input and produce the following output:

```
<html>
  <body>
    <div>
      <a>
      </a>
    </div>
  </body>
</html>
```

You do not need to handle singleton or self-closing tags. If the html is not valid (i.e., there are mismatched or missing tags), print an error. Thus, the following two strings should produce errors:

```
<html><body><div></a></body></html>
<html><body><div><a></div></a>
```

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3. Given an array of letters [a, b, c, d, e, f], write a **recursive** function that outputs the following structure:

```
<a>
  <b>
    <c>
      <d>
        <e>
          <f>
          </f>
        </e>
      </d>
    </c>
  </b>
</a>
```

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4. Write a program **using an object oriented approach** that reads a CSV file containing information about different regular convex polygons (i.e., all sides equal, all angles equal, lines do not cross), and circles. Each row of the file contains two columns, the first is the name of the shape, the second is the shape side length or radius. The program should output text describing the perimeter and area of each shape in the CSV file, or an error if the input data is invalid.

Your program should accept the following shapes:

- triangle
- square
- pentagon
- circle

The following represents an example CSV file the program should handle:

```
triangle,3.5
circle,2
```

Given the input above, your program should output:

```
A triangle with side length 3.5 u has a perimeter of 10.5 u and an area of 5.30 u^2
A circle with radius 2 u has a perimeter of 12.57 u and an area of 12.57 u^2
```

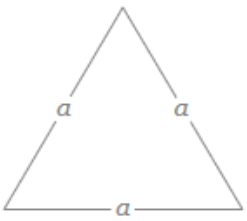
Along with the program code, include a separate CSV file where each row represents a different test case the program can handle. Be thorough when itemizing these test cases for exercising the above requirements.

Geometric formulas to get you started can be found on the following page.

Equilateral triangle

$$P = 3\,a$$

$$A = \frac{\sqrt{3}}{4}a^2$$

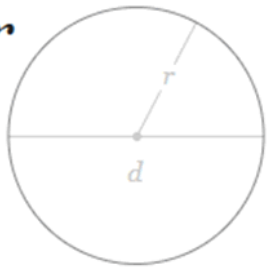


a Side

Circle

$$C = 2\,\pi\,r$$

$$A = \pi\,r^2$$

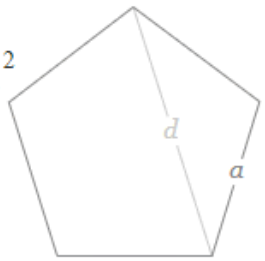


r Radius

Regular pentagon

$$P = 5\,a$$

$$A = \frac{1}{4}\sqrt{5\,(5+2\sqrt{5})}\,a^2$$



a Side