PROJECT DESIGN:

Team 10: SQL Samurai

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Mission Statement:

Developing a comprehensive database focused on monitoring and evaluating program performance and rankings within the Robert H. Smith School of Business at the University of Maryland. The goal is to provide accurate, timely data, enabling informed decision-making, program quality enhancement, and the ongoing strengthening of the school's competitive position in higher education. The scope is limited to Masters of Science (MS) and Masters in Business Administration (MBA) programs provided by the University of Maryland Smith School of Business in the United States.

Mission Objective for the client:

Our database project revolves around gathering, organizing, and analyzing information pertinent to the Master of Science (MS) and Master of Business Administration (MBA) programs offered by the Robert H. Smith School of Business at the University of Maryland. The objective is to create a comprehensive database that not only records the program rankings but also covers factors that potentially affect these rankings.

The database will support all CRUD operations and follow the guidelines and rules that are listed in the book - 'Modern Database Management 13th Edition' by Jeffrey A. Hoffer, V. Ramesh and Heikki Topi.

The database will also cover all concepts related to the DBMS - ER Schema, ER Diagram, Functional dependencies, Normalization, basic and advanced querying using Microsoft Server SQL Management Studio, DML, DDL, and more. The team will ensure that work is divided amongst the four of us covering all the required roles - information systems analyst, database designer, database developer, and application developer.

Here are some questions related to our various tables to extract meaningful information

1. Which is the highest ranking earned by each program at the Robert H. Smith School of Business over the years? Also, specify the year in which the highest ranking was achieved. Solve using a non-correlated subquery.
2. Who are the faculty members with the top 3 research grants? Specify all the details of the faculty along with the grant amounts in descending order.

3. For the year 2022, which programs had the best placement records, and what were the ranks achieved corresponding to these programs?

4. What are the details of the faculty members of the top-ranked program in the current year (i.e., 2023)? Also, display the courses being taught by the respective Faculty.

5. Create a view - For the currently top 2 ranked programs, what are the average GRE and TOEFL score requirements?

6. Create a view - Who are the alumni of the program that have achieved the highest ranking in 2023? What have they achieved?

To describe the database let us have a look at some of its key elements:

Entities:

- Program: Represents an academic program, each having a unique identifier and details such as name, degree type, credits count, intake, semester, average GPA, average GRE requirements, average TOEFL requirements and potential job roles.

- Rank: Contains information on the rank of each program for every year.

- Faculty: Encompasses the faculty members with their unique ID and includes attributes like name, tenure, title, qualification, date of joining, email, research interests, and department.

- Research: Details about research initiatives including an ID, title, area, and associated faculty.

- Placement: Tracks placement data with an ID, placement rate, average salary, graduation year, domains, companies, and locations for placements.

- Alumni: Records information about alumni such as their ID, graduation year, name, and current company they work in along with their designation.

Relationships:

- Achieve: Connects programs to ranks, indicating the specific program associated with a particular rank.

- Assign: Links faculty to programs, representing their affiliations with specific academic programs.

- <u>Conduct</u>: Shows which faculty member is conducting or associated with a particular research.
- <u>Associate</u>: Relates programs to their placement records and vice versa.
- <u>Attend</u>: Connects alumni to the programs they were a part of.

Business Description:

Information from multiple sources is incorporated into the data collection process. For example, program details, faculty information, and alumni records are captured in university records and reports. Historical ranking data is available from university data and annual ranking publications. Surveys, departmental files, and internet resources can be used to compile information on research grants, placements, and alumni successes. These data pieces are meticulously arranged into a database schema, guaranteeing that the relationships between the information are accurate. The ER Schema facilitates the establishment of various associations among programs, faculty, research, and placement records. This procedure creates a structured and centralized database that supports advanced SQL queries and plays a crucial role in academic decision-making.

ER Schema:

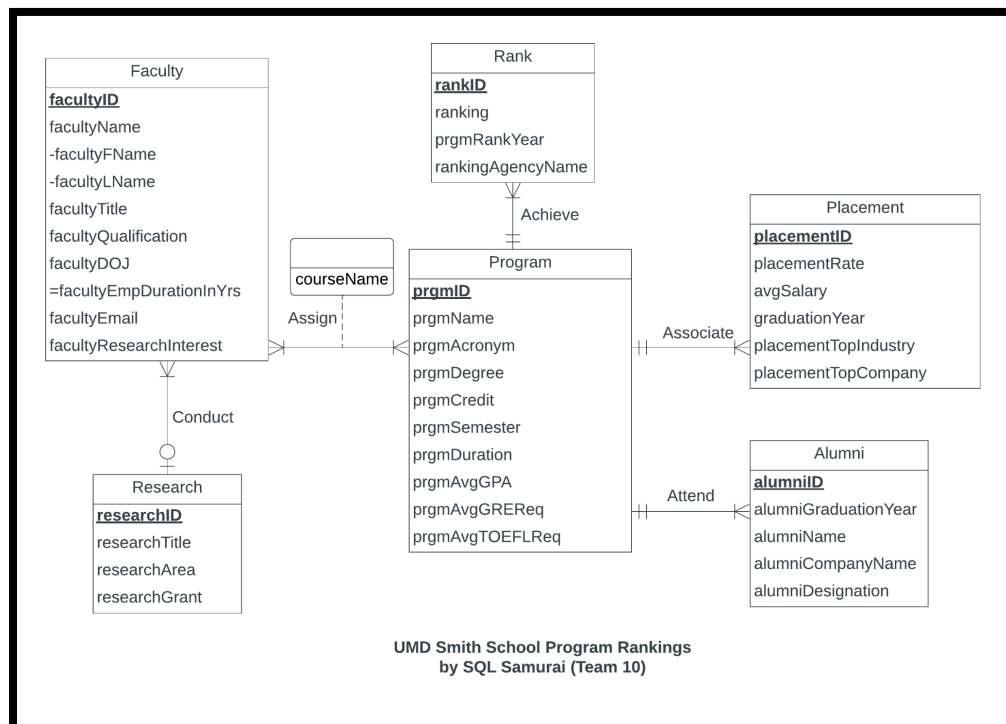**Entities, Attributes, and Primary keys:**

1. Program (**prgmID,** prgmName, prgmAcronym, prgmDegree, prgmCredit, prgmSemester, prgmDuration, prgmAvgGPA, prgmAvgGREReq, prgmAvgTOEFLReq)
2. Rank (**rankID,** ranking, prgmRankYear, rankingAgencyName)
3. Faculty (**facultyID**, facultyName, -facultyFName, -facultyLName, facultyTitle, facultyQualification, facultyDOJ, =facultyEmpDurationInYrs, facultyEmail, facultyResearchInterest)
4. Research (**researchID**, researchTitle, researchArea, researchGrant)
5. Placement (**placementID**, placementRate, avgSalary, graduationYear, placementTopIndustry, placementTopCompany)
6. Alumni (**alumniID**, alumniGraduationYear, alumniName, alumniCompanyName, alumniDesignation)

Relationships, Degrees, and Participating Entities:

1. Achieve: Binary relationship

1 program to 1 or more ranks

1 ranking to 1 program

2. Assign (courseName): Binary relationship

1 faculty to 1 or more programs (*Inferred so no limitation*)

1 program to 1 or more faculties

3. Conduct: Binary Relationship

1 faculty to only 1 research

1 research to only 1 faculty

4. Associate: Binary Relationship

1 program to 1 or more placement

1 placement to 1 program

5. Attend: Binary Relationship

1 alumni to 1 or more program

1 program to 1 or more alumni

ER Diagram:

UMD Smith School Program Rankings
by SQL Samurai (Team 10)

Relational Schema:

1. Program (**prgmID**, prgmName, prgmAcronym, prgmDegree, prgmCredit, prgmSemester, prgmDuration, prgmAvgGPA, prgmAvgGREReq, prgmAvgTOEFLReq)

2. Rank (**rankID,** ranking, prgmRankYear, rankingAgencyName, *prgmID*)

3. Faculty (**facultyID**, facultyFName, facultyLName, facultyTitle, facultyQualification, facultyDOJ, facultyEmail, facultyResearchInterest)

4. Research (**researchID**, researchTitle, reserchArea, researchGrant, *facultyID*)

5. Placement (**placementID**, placementRate, avgSalary, graduationYear, placementTopIndustry, placementTopCompany, *prgmID*)

6. Alumni (**alumniID**, alumniGraduationYear, alumniName, alumniCompanyName, alumniDesignation, *prgmID*)

7. Assign (courseName, ***prgmID, facultyID***)

Functional Dependencies:

1. prgmID -> prgmName, prgmAcronym, prgmDegree, prgmCredit, prgmSemester, prgmDuration, prgmAvgGPA, prgmAvgGREReq, prgmAvgTOEFLReq

2. rankID -> ranking, prgmRankYear, rankingAgencyName

3. facultyID -> facultyFName, facultyLName, facultyTitle, facultyQualification, facultyDOJ, facultyEmail, facultyResearchInterest

4. researchID -> researchTitle, researchArea, researchGrant

5. placementID-> placementRate, avgSalary, graduationYear, placementTopIndustry, placementTopCompany

6. alumniID -> alumniGraduationYear, alumniName, alumniCompanyName, alumniDesignation

7. prgmID, facultyID -> courseName

Normalization:

Step 1: 1NF

The table is already in 1NF form since there are no multivalued attributes.

Step 2: 2NF

The table is already in 2NF form since there are no partial dependencies. All of the attributes in the 1NF tables are fully functionally dependent on the primary key, so the tables are already in 2NF.

Step 3: 3NF

The table is already in 3NF form since there are no transitive dependencies.

Business Rules:

R1: When a Program is deleted from the database, the corresponding ranks associated with that program should also be deleted.

R2: When a Program is updated in the database, the corresponding ranks associated with that program should remain the same.

R3: When a Program is deleted from the database, the corresponding faculty details get edited.

R4: When a Program is updated in the database, the corresponding faculty members assigned to that program should not be modified.

R5: When a Program is deleted from the database, the corresponding placement details should be edited.

R6: When a Program is updated in the database, the corresponding placement details for that program should not change.

R7: When a Program is deleted from the database, the corresponding alumni details associated with that program should be edited.

R8: When a Program is updated in the database, the corresponding alumni details associated with that program should not be changed.

R9: When a research is deleted in the database, the corresponding faculty details associated with that research should not be modified and when a research is updated in the database, the corresponding faculty details associated with that research should not be changed.

R10: When a faculty is deleted from the database, corresponding research should also be deleted.

R11: When a faculty is updated in the database, corresponding research should not be modified.

Referential Integrities:

Relation	Foreign Key	Base Relation	Primary Key	Business Rule	Constraint: ON DELETE	Business Rule	Constraint: ON UPDATE
Achieve (Program)	prgmID	Rank	rankID	R1	CASCADE	R2	NO ACTION
Faculty	facultyID	Research	facultyID	R10	CASCADE	R11	NO ACTION
Program	prgmID	Alumni	prgmID	R7	CASCADE	R8	NO ACTION
Research	researchID	Faculty	researchID	R9	NO ACTION	R9	NO ACTION
Program	prgmID	Placement	prgmID	R5	CASCADE	R6	NO ACTION
Program	prgmID	Faculty	prgmID	R3	CASCADE	R4	NO ACTION

Sample Data:

Program Table:

prgmID	prgmName	prgmAcronym	prgmDegree	prgmCredit	prgmSemester	prgmDuration (Months)	prgmAvgGPA	prgmAvgGREReq	prgmAvgTOFELReq
01	Information Systems	IS	M.S.	30	3	16	3.5	310	100
02	Business Analytics	BA	M.S.	30	3	16	3.3	307	97
03	Supply Chain Management	SCM	M.S.	30	3	16	3.3	309	99

| 04 | Marketing Analytics | MA | M.S. | 30 | 3 | 16 | 3.5 | 310 | 100 |
| 05 | Quantitative Finance | QF | M.S. | 36 | 4 | 24 | 3.4 | 313 | 103 |

Rank Table:

rankID	ranking	prgmRankYear	rankingAgencyName	*prgmID*
01	11	2023	US News	01
02	31	2022	QS	02
03	28	2022	Top Universities	03
04	6	2017	College Factual	04
05	20	2022	Quantnet	05

Faculty Table:

facultyID	facultyName	facultyFName	facultyLName	facultyTitle	facultyQualification	facultyDOJ	facultyEmpDurationInYears	facultyEmail
01	John Bono	John	Bono	Associate Clinical Professor of Information Systems	Ph.D., Information Systems	2019	4	jbono@umd.edu
02	Tejwansh (Tej) Singh Anand	Tejwansh (Tej) Singh	Anand	Academic Director, MS in Information Systems	Ed.D	2021	2	tejanand@umd.edu
03	Sujin Kim	Sujin	Kim	Associate Clinical	Ph.D. in Operation	2016	7	kimsj22@umd.edu

				Professor	s Research and Information Engineering			
04	Woei-jyh (Adam) Lee	Woei-jyh (Adam) Lee	Lee	Associate Clinical Professor	Ph.D Bioinformatics	2012	11	adamlee@umd.edu
05	Kislaya Prasad	Kislaya	Prasad	Academic Director, Center for Global Business	Ph. D in Economics	2005	18	kprasad@umd.edu

Research Table:

researchID	researchTitle	researchArea	researchGrant	*facultyID*
01	Responsible AI: The Adoption of AI in Retail Product Pricing and Social Equity and Inclusion for Consumers	Artificial Intelligence	150000	35
02	Detecting and Mitigating Toxic Content in Online Platforms	Artificial Intelligence	130000	21
03	Data-Driven Fight Against Pandemics	Data Analysis	90000	36
04	Collaborative: Role of Intellectual Capital in predicting outcomes of Entrepreneurial Firms	Finance	240000	37

| 05 | The Heterogeneous Diffusion of AI Skills," and the creation of the "Smith AI Index | Artificial Intelligence | NULL | 09 |

Placement Table:

placementID	placementRate(%)	avgSalary	graduationYear	placementTopIndustry	placementTopCompany	*prgmID*
01	95	83000	2022	Internet and Cloud Computing	Google	1
02	85	83000	2022	Financial Services	CapitalOne	2
03	90	77000	2022	Hospitality Service Provider	Marriott International	3
04	80	78780	2022	Social Networking	Facebook	4
05	89	85000	2022	Financial Services	Citi	5

Alumni Table:

alumniID	alumniGraduationYear	alumniName	alumniCompanyName	alumniDesignation	*prgmID*
01	1950	Robert H. Smith	JBG Smith	Real Estate Developer	01
02	1950	Leo Van Munching	Heineken	CEO	08
03	1954	Allen J. Krowe	IBM	CFO	08
04	1955	Ed Snider	Comcast	Chairman	06
05	1966	William Mayer	Credit Suisse	CEO	08

Assign Table:

facultyID	*prgmID*	**courseName**
01	01	BUDT704
03	02	BUDT731
02	01	BUDT721
02	01	BUDT722
04	01	BUDT702
04	02	BUDT702
05	08	BUSM761