Database System: Formel 1

Group 31

af:

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Contents

1 Statement of requirements

The database Formula 1 is organized into teams with unique team names. Each team has a contract with one or more drivers with a certain start date. Furthermore each team employs staff of different roles and salaries. Each team also has a number of cars with unique ID's.

A driver has one or more cars that the driver drives.

Races are held throughout the season at different dates. Each race has a unique name and is held at one of multiple venues at different locations. The venues has a certain capacity, length of the course and build year.

2 Conceptual design

The relations between the entities are as follows.

Drives

All drivers are assigned to one or more cars. A car does not necessarily have a driver, as it can be a new car, yet to be assigned to a driver.

Owns

All cars are assigned to a team, and all teams have cars. Each team can have more than one car.

Contract

All drivers are on a contract with a team, and all teams have one or more drivers on contract. The contract relation, has a attributed called start date, which is the start date of the contract.

Employed

All teams have staff and all team staff are assigned to a team. A team has one or more staff members. The employed relation has the attribute salary.

Wins

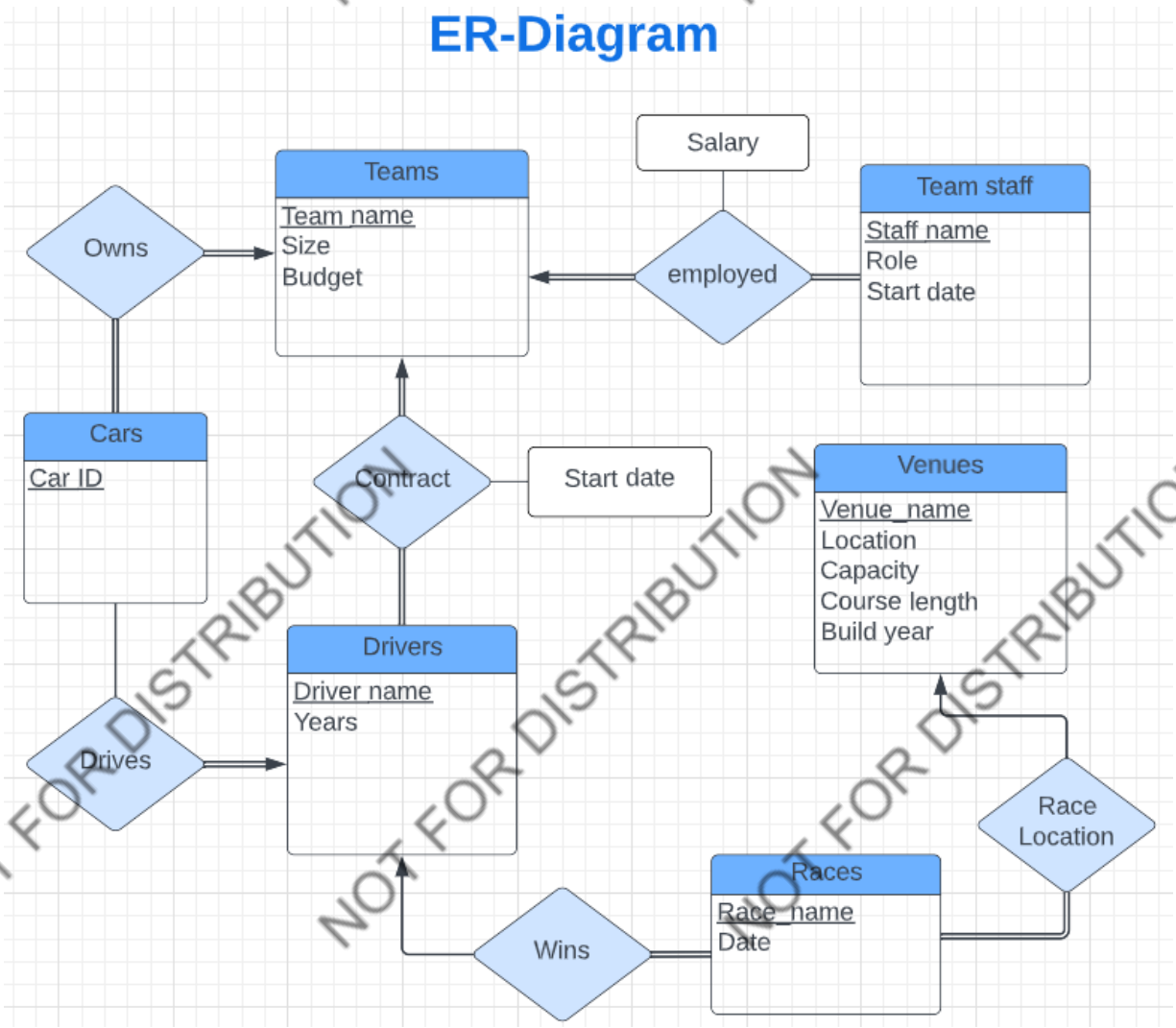
Alle races have a winner, but not alle drivers have a win. One driver can have multiple wins.

Race Location

All races have a location, but not all venues neccesarily have a race, as it can be a new venue that is yet to be raced. A venue can possibly host multiple races.

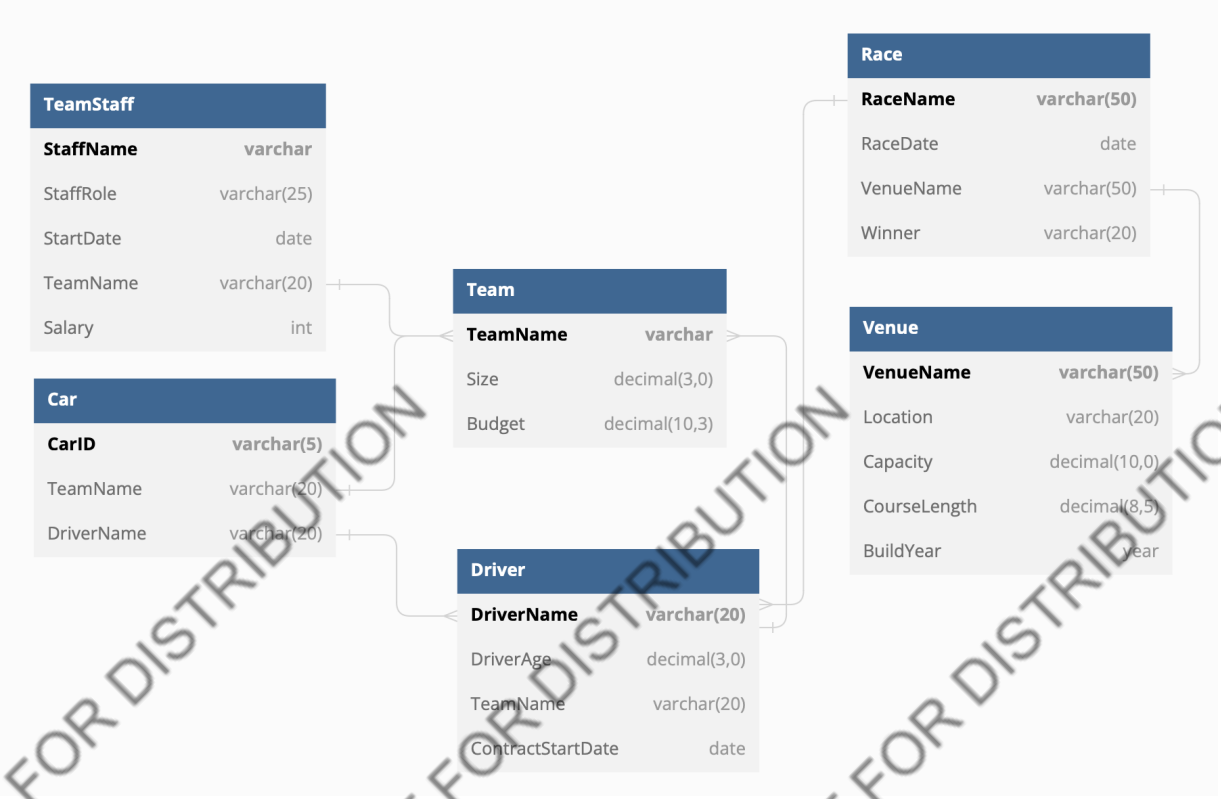
ER-diagram

Based on the infomation above the following ER-diagram is constructed:



3 Logical design

All relations from the conceptual design are many-to-one relations. Therefore a database can be constructed by adding the primary key of the one-side, and the attributes of the relation, to the many-side. This yields the following database as visualised in the logical diagram:



4 Implementation

The database from chapter 3 can be implemented with the following SQL-code:

```
CREATE TABLE Team
    (TeamName VARCHAR(20),
    Size DECIMAL(3,0),
    Budget DECIMAL(10,3),
    PRIMARY KEY(TeamName)
);

CREATE TABLE TeamStaff
    (StaffName VARCHAR(20),
    StaffRole VARCHAR(25),
    StartDate DATE NOT NULL,
    TeamName VARCHAR(20),
    Salary INT,
    PRIMARY KEY(StaffName),
    FOREIGN KEY(TeamName) REFERENCES Team(TeamName) ON DELETE CASCADE
);
```

```
CREATE TABLE Driver
    (DriverName VARCHAR(20),
    DriverAge DECIMAL(3,0),
    TeamName VARCHAR(20),
    ContractStartDate DATE,
    PRIMARY KEY(DriverName),
    FOREIGN KEY(TeamName) REFERENCES Team(TeamName) ON DELETE CASCADE
);

CREATE TABLE Car
    (CarID VARCHAR(5),
    TeamName VARCHAR(20),
    DriverName VARCHAR(20),
    PRIMARY KEY(CarID),
    FOREIGN KEY(TeamName) REFERENCES Team(TeamName) ON DELETE SET NULL,
    FOREIGN KEY(DriverName) REFERENCES Driver(DriverName) ON DELETE SET NULL
);

CREATE TABLE Venue
    (VenueName VARCHAR(50),
    Location VARCHAR(20),
    Capacity Decimal(10,0),
    CourseLength Decimal(8,5),
    BuildYear Year,
    PRIMARY KEY(VenueName)
);

CREATE TABLE Race
    (RaceName VARCHAR(50),
    RaceDate DATE,
    VenueName VARCHAR(50),
    Winner VARCHAR(20),
    PRIMARY KEY(RaceName),
    FOREIGN KEY(VenueName) REFERENCES Venue(VenueName) ON DELETE CASCADE,
    FOREIGN KEY(Winner) REFERENCES Driver(DriverName)
);
```

We have decidede to create 2 views. The first view displays the avg salary of each Staff Role.

```
CREATE VIEW RoleAvgSalary AS
    Select StaffRole, Avg(Salary) as AvgSalary from TeamStaff
    Group By StaffRole
    Order By AvgSalary DESC;
```

The second view display each teams total salary compared to their budget:

```
CREATE VIEW TeamBudgetSalary AS
    Select TeamName, Budget, Sum(Salary) as TotalSalary
    from Team Natural Join TeamStaff
    Group By TeamName;
```

5 Database instance

Database can be inserted into the tables using the `INSERT`-command:

```
INSERT INTO Driver (DriverName, DriverAge, TeamName, ContractStartDate) VALUES
('Lewis Hamilton', 36, 'Mercedes', '2018-09-19'),
('Valtteri Bottas', 32, 'Mercedes', '2021-01-01'),
('Max Verstappen', 24, 'Red Bull Racing', '2020-10-10'),
('Sergio Perez', 31, 'Red Bull Racing', '2021-11-01'),
('Lando Norris', 22, 'McLaren', '2022-08-01'),
('Daniel Ricciardo', 32, 'McLaren', '2021-10-01'),
('Charles Leclerc', 24, 'Ferrari', '2021-08-04'),
('Carlos Sainz', 27, 'Ferrari', '2022-07-01');
```

CarID	TeamName	DriverName
C001	Mercedes	Lewis Hamilton
C002	Mercedes	Valtteri Bottas
C003	Mercedes	NULL
C004	Red Bull Racing	Max Verstappen
C005	Red Bull Racing	Sergio Perez
C006	Red Bull Racing	NULL
C007	McLaren	Lando Norris
C008	McLaren	Daniel Ricciardo
C009	McLaren	NULL
C010	Ferrari	Charles Leclerc
C011	Ferrari	Carlos Sainz
C012	Ferrari	NULL
NULL	NULL	NULL

DriverName	DriverAge	TeamName	ContractStartDate
Carlos Sainz	27	Ferrari	2022-07-01
Charles Leclerc	24	Ferrari	2021-08-04
Daniel Ricciardo	32	McLaren	2021-10-01
Lando Norris	22	McLaren	2022-08-01
Lewis Hamilton	36	Mercedes	2018-09-19
Max Verstappen	24	Red Bull Racing	2020-10-10
Sergio Perez	31	Red Bull Racing	2021-11-01
Valtteri Bottas	32	Mercedes	2021-01-01
NULL	NULL	NULL	NULL

TeamName	Size	Budget
Ferrari	6	4250000.000
McLaren	6	4000000.000
Mercedes	6	5000000.000
Red Bull Racing	6	4500000.000
NULL	NULL	NULL

VenueName	Location	Capacity	CourseLength	BuildYear
Albert Park Circuit	Australia	80000	5.30300	1996
Circuit de Barcelona-Catalunya	Spain	140700	4.65500	1991
Circuit de Monaco	Monaco	20000	3.33700	1929
Monza Circuit	Italy	113000	5.79300	1922
Nürburgring	Germany	150000	5.14800	1927
Silverstone Circuit	UK	150000	5.89100	1948
Suzuka Circuit	Japan	155000	5.80700	1962
NULL	NULL	NULL	NULL	NULL

RaceName	RaceDate	VenueName	Winner
Australian Grand Prix	2022-03-20	Albert Park Circuit	Valtteri Bottas
British Grand Prix	2022-07-17	Silverstone Circuit	Lewis Hamilton
German Grand Prix	2022-07-31	Nürburgring	Lewis Hamilton
Italian Grand Prix	2022-09-11	Monza Circuit	Max Verstappen
Japanese Grand Prix	2022-10-09	Suzuka Circuit	Sergio Perez
Monaco Grand Prix	2022-05-29	Circuit de Monaco	Max Verstappen
Spanish Grand Prix	2022-05-08	Circuit de Barcelona-Catalunya	Lewis Hamilton
NULL	NULL	NULL	NULL

StaffName	StaffRole	StartDate	TeamName	Salary
Alex Smith	Team Principal	2019-06-01	Ferrari	155000
Bob Johnson	Mechanic	2020-05-01	Mercedes	75000
Chris Davis	Mechanic	2017-07-01	Red Bull Racing	70000
Dave Williams	Team Principal	2015-01-01	Red Bull Racing	140000
Emily Brown	Marketing Manager	2021-01-01	Mercedes	90000
Emma Brown	Marketing Manager	2017-07-01	Ferrari	95000
Jane Doe	Race Engineer	2016-02-15	Mercedes	100000
John Smith	Team Principal	2019-07-01	Mercedes	150000
Julia Brown	Marketing Manager	2018-05-01	McLaren	80000
Linda Taylor	Marketing Manager	2022-02-15	Red Bull Racing	85000
Lucy Lee	Race Engineer	2022-05-01	McLaren	90000
Mark Johnson	Mechanic	2014-01-01	McLaren	70000
Oliver Johnson	Mechanic	2021-02-15	Ferrari	75000
Sarah Lee	Race Engineer	2020-03-01	Red Bull Racing	95000
Sophie Davis	Race Engineer	2020-01-01	Ferrari	100000
Tom Jones	Team Principal	2015-09-01	McLaren	135000
NULL	NULL	NULL	NULL	NULL

Data instances for all tables

The tables for the two views:

	StaffRole	AvgSalary
▶	Team Principal	145000.0000
	Race Engineer	96250.0000
	Marketing Manager	87500.0000
	Mechanic	72500.0000

View1: RoleAvgSalary

	TeamName	Budget	TotalSalary
▶	Ferrari	4250000.000	425000
	McLaren	4000000.000	375000
	Mercedes	5000000.000	415000
	Red Bull Racing	4500000.000	390000

View2: TeamBudgetSalary

6 SQL data queries

First we have decided to write a select statement that display the Driver Name and their number of wins in descending order:

```
SELECT DriverName,
    (Select Count(Winner) from Race where Winner = DriverName) AS Wins
    from Driver Order By Wins DESC;
```

	DriverName	Wins
▶	Lewis Hamilton	3
	Max Verstappen	2
	Sergio Perez	1
	Valtteri Bottas	1
	Carlos Sainz	0
	Charles Leclerc	0
	Daniel Ricciardo	0
	Lando Norris	0

Driver Wins

Then we have created a querry that joins the race and venue tables and displays the chosen columns where the capacity is greater than 100,000:

```
SELECT RaceName, RaceDate, VenueName, Location, Capacity, CourseLength
    from Race Natural Join Venue
    where Capacity>100000;
```

	RaceName	RaceDate	VenueName	Location	Capacity	CourseLength
▶	British Grand Prix	2022-07-17	Silverstone Circuit	UK	150000	5.89100
	German Grand Prix	2022-07-31	Nürburgring	Germany	150000	5.14800
	Italian Grand Prix	2022-09-11	Monza Circuit	Italy	113000	5.79300
	Japanese Grand Prix	2022-10-09	Suzuka Circuit	Japan	155000	5.80700
	Spanish Grand Prix	2022-05-08	Circuit de Barcelona-Catalunya	Spain	140700	4.65500

Join Race and Venue. Capacity ¿ 100000

Lastly we have created a querry that displays the average salary of each team in descending order:

```
SELECT TeamName, Avg(Salary) As AvgSalary
    From TeamStaff
    Group By TeamName
    Order By AvgSalary DESC;
```

	TeamName	AvgSalary
▶	Ferrari	106250.0000
	Mercedes	103750.0000
	Red Bull Racing	97500.0000
	McLaren	93750.0000

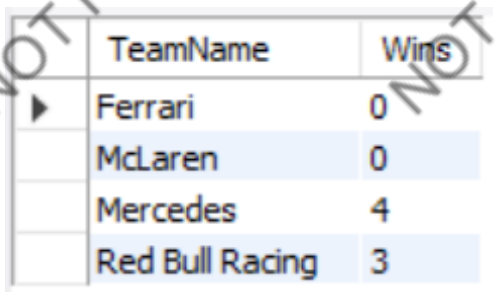
Average salary by team

7 SQL programming

Function

We have created a function TeamWon that counts the number of wins for each driver grouped by team. Because we want the number of wins we declare the return statement as an integer.

```
DELIMITER //
create function TeamWon (vwinner varchar(20)) returns int
begin
    declare vTeamWon int;
    select count(*) into vTeamWon from Race
    where winner = vwinner;
    return vTeamWon;
end; //
 delimiter  ;
select TeamName, sum(TeamWon(drivername)) as Wins from Car
GROUP BY TeamName;
```



TeamName	Wins
Ferrari	0
McLaren	0
Mercedes	4
Red Bull Racing	3

Number of wins

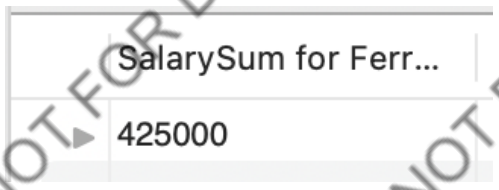
Procedure

We have created a procedure that sums how many money a team use on salary for their teamstaff. This procedure has 1 input variable, 1 output variable but no side effects on tables

```
DELIMITER //
CREATE PROCEDURE SalarySum (IN vTeamName VARCHAR(20), OUT vSalary INT)
       BEGIN
         SELECT SUM(salary) INTO vSalary FROM TeamStaff
         WHERE TeamName = vTeamName;
       END//

DELIMITER ;

CALL salarysum('Ferrari', @vSalary);
SELECT @vsalary as 'SalarySum for Ferrari';
```



SalarySum for Ferr...
425000

Salary sum for Ferraris Teamstaff

Trigger

The size of a team is dependent on the number of staff that is employed by the team. Therefore, if a member of the team staff is removed the size of the team should also be reduced by 1. This can be achieved automatically by the use of a trigger that reduces Size of a team in the table Team when a row in the table TeamStaff is deleted:

```
DELIMITER //
CREATE TRIGGER ReduceTeamSize
AFTER DELETE ON TeamStaff
FOR EACH ROW
BEGIN
    UPDATE Team SET Size = Size - 1 WHERE Team.TeamName = old.TeamName;
END//
DELIMITER ;
```

8 SQL table modifications

Deleting a car with a certain ID can be achieved by:

```
DELETE FROM Car WHERE CarId='C003';
```

Deleting an older venue built before the year 1930 can be achieved by:

```
DELETE FROM Venue WHERE BuildYear < 1930;
```

Raising the salary of all Mercedes staff that earns below $100.000 up to $100.000 can be achieved by:

```
UPDATE TeamStaff SET Salary=100000 WHERE TeamName='Mercedes' AND Salary<100000;
```

The three above queries directly affects the tables Car, Venue and Race. Furthermore, the table Race is also affected since a race is deleted if the venue is deleted due to the foreign key constrain `ON DELETE CASCADE`. The four affected tables are after the queries:

CarID	TeamName	DriverName
C001	Mercedes	Lewis Hamilton
C002	Mercedes	Valtteri Bottas
C004	Red Bull Racing	Max Verstappen
C005	Red Bull Racing	Sergio Perez
C006	Red Bull Racing	NULL
C007	McLaren	Lando Norris
C008	McLaren	Daniel Ricciardo
C009	McLaren	NULL
C010	Ferrari	Charles Leclerc
C011	Ferrari	Carlos Sainz
C012	Ferrari	NULL
NULL	NULL	NULL

Car

StaffName	StaffRole	StartDate	TeamName	Salary
Alex Smith	Team Principal	2019-06-01	Ferrari	155000
Bob Johnson	Mechanic	2020-05-01	Mercedes	100000
Chris Davis	Mechanic	2017-07-01	Red Bull Racing	70000
Dave Williams	Team Principal	2015-01-01	Red Bull Racing	140000
Emily Brown	Marketing Manager	2021-01-01	Mercedes	100000
Emma Brown	Marketing Manager	2017-07-01	Ferrari	95000
Jane Doe	Race Engineer	2016-02-15	Mercedes	100000
John Smith	Team Principal	2019-07-01	Mercedes	150000
Julia Brown	Marketing Manager	2018-05-01	McLaren	80000
Linda Taylor	Marketing Manager	2022-02-15	Red Bull Racing	85000
Lucy Lee	Race Engineer	2022-05-01	McLaren	90000
Mark Johnson	Mechanic	2014-01-01	McLaren	70000
Oliver Johnson	Mechanic	2021-02-15	Ferrari	75000
Sarah Lee	Race Engineer	2020-03-01	Red Bull Racing	95000
Sophie Davis	Race Engineer	2020-01-01	Ferrari	100000
Tom Jones	Team Principal	2015-09-01	McLaren	135000
NULL	NULL	NULL	NULL	NULL

Team Staff

	VenueName	Location	Capacity	CourseLength	BuildYear
▶	Albert Park Circuit	Australia	80000	5.30300	1996
	Circuit de Barcelona-Catalunya	Spain	140700	4.65500	1991
	Silverstone Circuit	UK	150000	5.89100	1948
	Suzuka Circuit	Japan	155000	5.80700	1962
	NULL	NULL	NULL	NULL	NULL

Venue

	RaceName	RaceDate	VenueName	Winner
▶	Australian Grand Prix	2022-03-20	Albert Park Circuit	Valtteri Bottas
	British Grand Prix	2022-07-17	Silverstone Circuit	Lewis Hamilton
	Japanese Grand Prix	2022-10-09	Suzuka Circuit	Sergio Perez
	Spanish Grand Prix	2022-05-08	Circuit de Barcelona-Catalunya	Lewis Hamilton
	NULL	NULL	NULL	NULL

Race