Solutions to 2024 SH1 CA2 Theory

Q1

(a) ProjectID, EmployeeID [1]

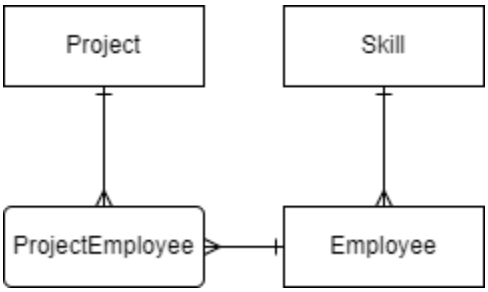
(b) For a table to be in 2NF, it must be

- In 1NF
- All the non-key attributes must be fully dependent on the primary key (ProjectID, EmployeeID), (either one of these reasons) [2]
  i. ProjectTitle, Start Date, End Date, which are non-key attributes are dependent only on the ProjectID attribute. Therefore it is not in 2NF
  ii. EmployeeName, SkillID, SkillName, CostPerHour is dependent only on the EmployeeID. Therefore it is not in 2NF
  iii. Only Hours Worked is dependent fully on the primary key (ProjectID, EmployeeID). Therefore it is not in 2NF

(c) Any 3 [2]

- Insert anomaly, when a new employee joins the company, he may not be assigned a project, a record cannot be created since the ProjectID is part of the Primary Key.

(d)



1m – Project, Employee, Skill

1m – ProjectEmployee

1m- relationship between Employee, Skill

2m – Project, ProjectEmployee, Employee relationships

(e)

- Project(ProjectID, ProjectTitle, StartDate, EndDate)
- Skill (SkillID, SkillName, CostPerHour)
- Employee(EmployeeID, EmployeeName, SkillID*)
- ProjectEmployee(ProjectID*, EmployeeID*, HoursWorked)

- All attributes captured [2], -1 for 1 missing attribute
- All PKs correct [1]
- All FKs correct[1]

(f)

- Add the relation Customer(CustomerRef,Name, Address) [2]

- Add a FK reference on the Project relation to reference the Customer table using the CustomerRef attribute. [1]

(g) When the carpenters' hour cost is updated after a carpenter has been asigned to a project, the cost computed when the invoice is billed to the customer is not correct,as it is computed based on the updated hourly cost and not based on the hourly cost at the start of the project.[2]

(h) The cost incured by a customer should be calcualted based on the Actual CostPerHour of the different skills at the beginning of the project. This can done by adding an attribute CostPerHour in the ProjectEmployee relations and the data inserted at the beginning of the project. This value should not be updated when the CostPerHour is updated in the Skill relation. [2]

(i) [1] JOIN, [1] WHERE

```
SELECT * FROM Employee
INNER JOIN Skill ON Employee.SkillID = Skill.SkillID
WHERE Skill.SkillName = 'Carpentry'
```

Q2

Final result = 16

Trace Table

Function call	number	return
calc(3)	3	2 + 14 =16
calc(2)	2	2 + 12 = 14
calc(1)	1	2 + 10 = 12
calc(0)	0	10

Trace Tree