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Advanced Higher Computing Science

Database decomposition and entity-relationship diagrams workshop materials

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Introduction

This document is for teachers and lecturers and/or Advanced Higher Computing Science candidates.

This document contains database decomposition and entity-relationship diagrams questions and accompanying marking instructions devised for the workshop at an Understanding Standards event held in 2023.

Questions

1. A company has a number of employees. Each employee in the company can be assigned to one or more projects. A project can have several employees assigned. The company wants to store details of employees and projects in a database system.

   Create an entity-relationship diagram to represent this system. Your diagram should indicate:

   - strong and weak entities
   - mandatory and optional participation in each relationship

2. A university library uses a database system to store details about students and the books they borrow.

   Create an entity-relationship diagram to represent this system.

3. A yacht club uses a database system to store details of skippers, boats and races.

   When planning the entities in the database system, the following constraints must be considered:

   - Several boats can participate in a race and many boats will take part in each race.
   - All boats belong to exactly one class (a class is a type of boat, for example, Piper and Etchells) and several of the club's boats belong to the same class.
   - The club doesn't always have boats that satisfy the criteria for every class.
   - Every race is for one specific class of boat; over the season, there will be several races for each class of boat, but not every class will have the opportunity to race.
   - Although some skippers don't have a boat, every boat must have exactly one skipper who only sails that one boat.

   Create an entity-relationship diagram to represent this system. Your ERD should indicate:

   - possible attributes that would be stored in each entity
   - strong and weak entities
   - mandatory and optional participation in each relationship

4. A rambling club uses a database system to store details of local walks (walk ID, start point, end point, length in kilometres) and members (membership number, forename, surname, phone number).

   The club organises regular group walks, with each walk based on one specific local walk. Over the year, each local walk can be used for one or more of the group walks and members can complete any of the group walks on more than one occasion.

   The club wants to extend its database to store details of the group walks, the group walks completed by each member, and to allow members to review any group walk they complete.

   Create an entity-relationship diagram to represent the rambling club's updated database.

5. A primary school rewards its pupils with badges for positive achievements. The school wants to store details of its pupils and the badges that are awarded to each pupil.

   When planning the entities in the database system, the following constraints must be considered:

   ♦ Pupils can earn many different badges, and individual badges can be awarded to any number of pupils.
   ♦ Each pupil is in one class of the school (for example P4) with each class having up to 30 pupils.

   Draw an entity-relationship diagram to represent the entities needed in the school database system. Your diagram should suggest possible attributes that would be stored in each entity.

6. A database system is used to store data about camping products and suppliers, the prices charged by each supplier, and the stock level available from each supplier.
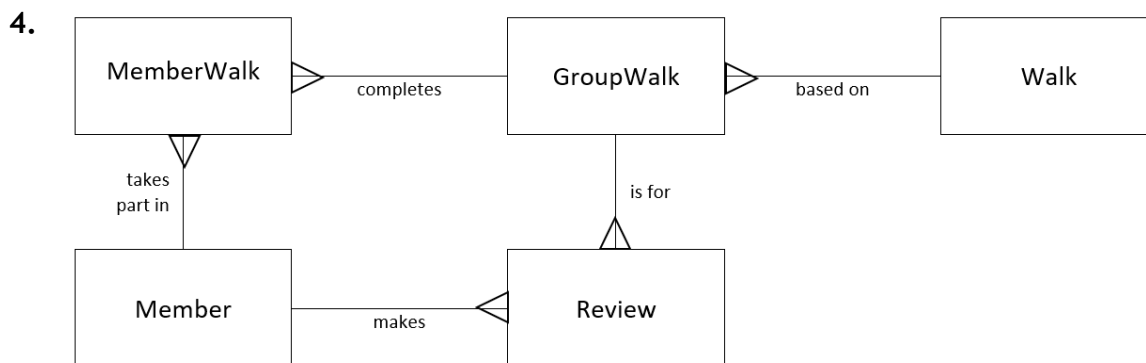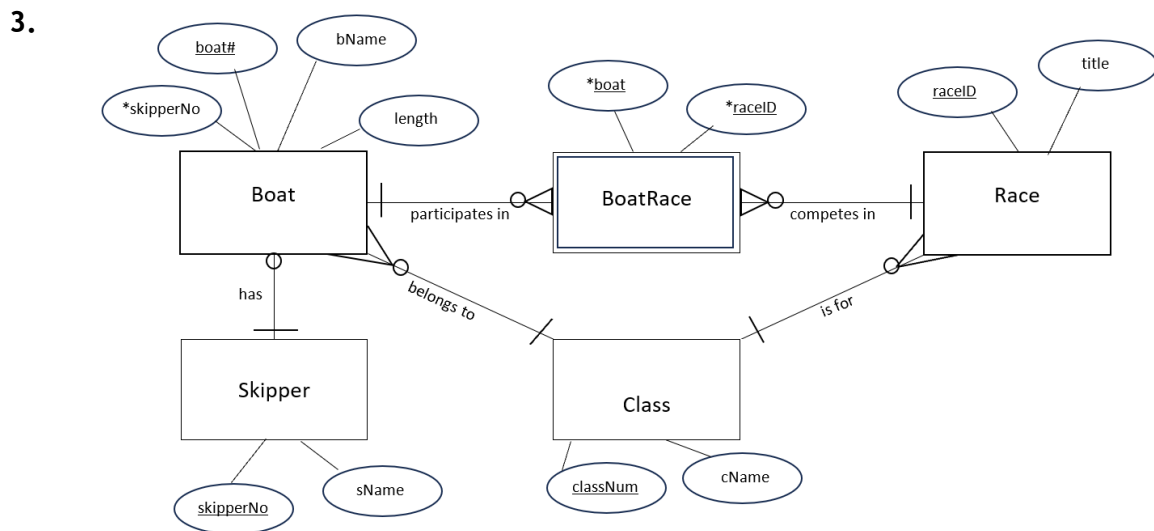
Some sample data stored in the database is shown below.

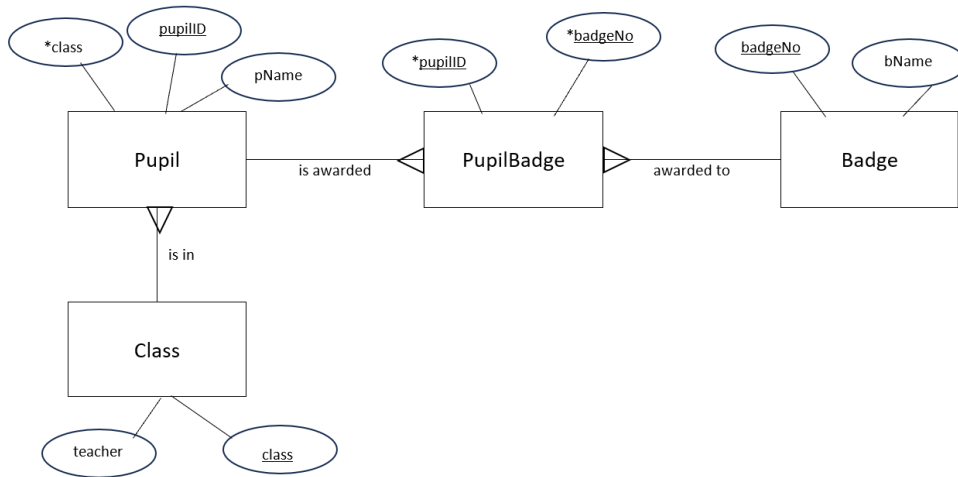| Product#	Description	StockLevel	Supplier#	SupplierName	Phone	SellingPrice
787800	Small Stove	31	3345	HikeAway	01313338675	13.25
787800	Small Stove	16	5678	Trek Scotland	01317778654	16.39
787800	Small Stove	5	1123	Camping Kit	01962874532	18.09
656554	Sleeping bag: green	33	1123	Camping Kit	01962874532	34.99
780125	Sleeping bag: red	12	1123	Camping Kit	01962874532	34.99
354221	4-man tent	1	1123	Camping Kit	01962874532	123.75
354221	4-man tent	8	4659	Tent City	01717651234	101.99

Draw an entity-relationship diagram to represent the entities needed in the database system. Your diagram should indicate:

♦ the attributes that would be stored in each entity
♦ strong and weak entities
♦ mandatory and optional participation in each relationship

Marking instructions

1.

Employee —|— assigned to —o<— EmployeeProject —>o— developed by —|— Project

2.

Student —— borrows —<— StudentBook —>— borrowed by —— Book

3.

4.

5.

6.