National College of Ireland

Higher Diploma in Science in Computing

HDAIML_SEP, HDAIML_SEPOL, HDBC_SEPOL, HDCSDEV_INT, HDSDEV_SEP
Semester I, January Repeat

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Introduction to Databases

Yalemisew Abgaz
David Hamill
Eugene McLaughlin
Hicham Rifai

This TABA will cover the following learning outcomes

LO1 Analyse and evaluate current and future trends in database technologies
LO2 Construct and evaluate data models based on analysis of data requirements
LO3 Comprehend and describe the relational database model
LO4 Design, implement and evaluate a relational database system with an appropriate database package
LO5 Formulate and assess advanced SQL queries and commands

Exam Instructions

Please read carefully all instructions before starting the exam

Submission: Two links are available on Moodle for the submission of TABA. Link 1 is mandatory to upload TABA report.

Link 1 (Mandatory): Upload **Single file** (MS Word/ pdf) report submission including SQL code, illustrations, images, snaps or handwritten work (Turnitin link). Please, use the format below for the filename.

[LastName]_[FirstName]_[Program]_IDB_TABA

Link 2: Upload zip folder that may contain any supporting material (SQL code files or any images or snaps, for the justification of your answers in the submitted report at link 1)

[LastName]_[FirstName]_[Program]_IDB_TABA_SUP.zip

Turnitin database will be used to check the plagiarism of submitted report at link 1.

Citrix Tools available: MySQL Workbench, Microsoft Visio and MS Office are available to complete this TABA. Include reference to any material you have used to answer the questions.

Note: ***This is an individual personal assignment, co-operation or collaboration among students is strictly not allowed and may result in disqualification. Students may be asked to outline/explain in person the reason for any approach taken or solution provided.***

Attempt all questions and each question worth 20 marks in total. Choose the appropriate option for Q3 and Q4.

Carefully examine the following description and Entity Relationship Diagram and answer Question 1, and 2

National Aviation Authority (NAA)

A national aviation authority wants to collect all the data related to flights, pilots and aircrafts operated by airlines. The database designers of the authority came up with the following ER diagram with four entities and three relationship types (read left to right).

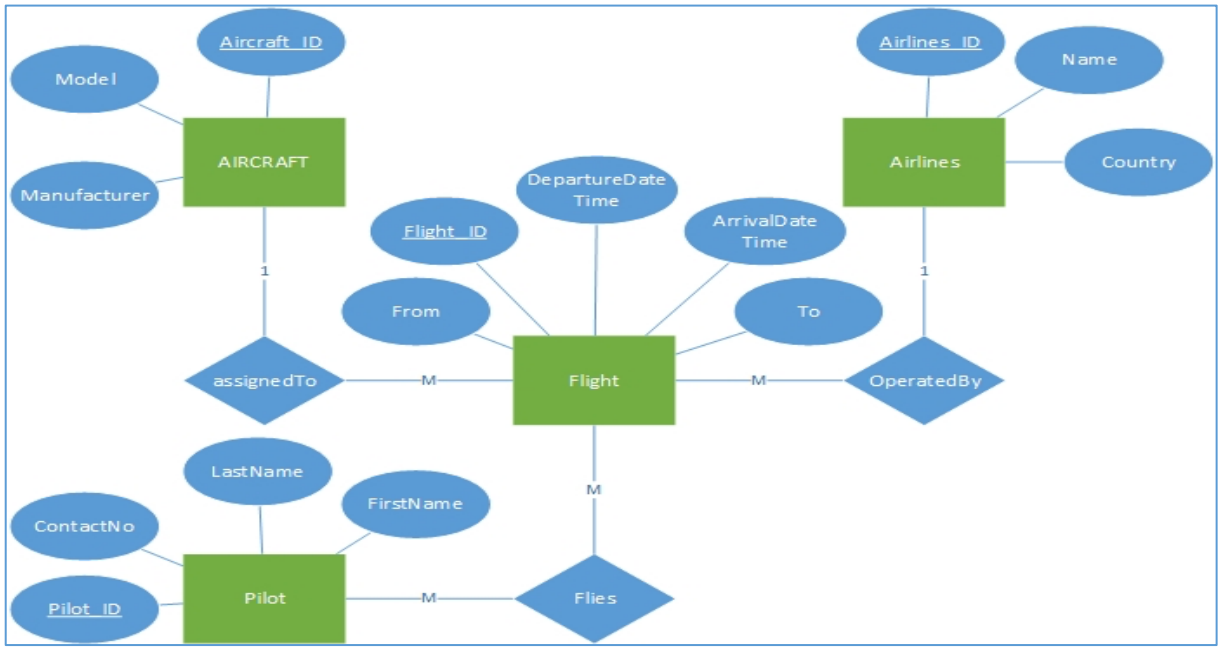

Figure 1. ER diagram for NAA database design

1. **Transform the conceptual design (ER diagram) into a physical design by converting the entities and relationships into their appropriate tables. Check if your tables are normalized using 1st, 2nd, and 3rd normal form. [20 Marks]**

2. **Create a database called NAA and convert all the resulting logical tables from question 1 into a physical database design using DDL. Choose the appropriate datatype, primary and foreign**

keys for the attributes. Provide detailed assumptions for any of your design decisions. [20 Marks]

3. **Explain the role of indexing in databases. Explain the criteria for determining the right type of index to be used for a given column in a table. Explain your answer with examples. Construct a B-Tree of order 3 (Knuth). Keys arrive in the following order**
   A. **14, 25, 24, 7, 9, 23, 45, 1, 5, 19, 4, 31, 35, 13, 11, 8, 3, 56.**
   B. **22, 10, 5, 2, 6, 33, 75, 4, 36, 45, 57, 9, 1, 11, 20, 19, 15, 55.**
   C. **74, 68, 44, 81, 76, 54, 26, 41, 22, 92, 38, 9, 80, 1, 62, 7, 8, 2.**
   D. **5, 19, 4, 31, 35, 13, 11, 8, 3, 56, 33, 75, 36, 45, 57, 9, 1, 2.**

   Demonstrate with example how the B-Tree index improves the retrieval time comparing it with the non-indexed (original) order of the data. [20 Marks]

   If your NCI ID ends with
   0,1 or 2 use the first list (a)
   3,4 or 5 use the second list (b)
   6,7 use the third list (c)
   8,9 use the fourth list (d)

4. **Discuss the pros and cons of non-relational databases by choosing one of the contexts below. Explain your answers with examples. Discuss the four types of non-relational databases along with the scenarios suitable to use and avoid them. [20 Marks, Maximum 600 Words]**
   A. **Context 1: E-commerce, social media**
   B. **Context 2: Video and audio sharing platforms**
   C. **Context 3: Covid-19 contact tracing**
   D. **Context 4: Academic record management system**

   If your NCI ID ends with
   0,1 or 2 use context 1
   3,4 or 5 use context 2
   6,7 use context 3
   8,9 use context 4

5. **Discuss the use of database role and privilege to secure a database system. Discuss the available grant options and how they enable the database administrator to control access. Discuss the role of views in controlling database access. [20 Marks, Maximum 600 Words]**