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UNIVERSITY OF LONDON

279 0103 ZB

BSc degrees and Diplomas for Graduates in Economics, Management, Finance and the Social Sciences, the Diploma in Economics and Access Route for Students in the External Programme

Elements of Information and Communication Technologies

Tuesday, 23 May 2006 : 2.30pm to 5.30pm

Candidates should answer **FIVE** of the following **ELEVEN** questions: **ONE** from Section A (40 marks) and **TWO** from **each of two** of the remaining Sections B, C and D (20 marks each). **Candidates are strongly advised to divide their time accordingly.**

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SECTION A: Principles of Programming

Answer **one** question from this section (40 marks).

1. (a) A government taxes the annual salary of its citizens according to several different rules. There is no taxation on the first \$2,000. \$2,001 to \$10,000 is taxed at 10%, \$10,001 to \$40,000 is taxed at 20%, and amounts over \$40,000 are taxed at 40%. For example, if someone's annual salary is \$15,000, then they pay no tax on the first \$2,000, 10% tax on \$2,001 to \$10,000, and 20% on \$10,000 to \$15,000. A program is needed by the government to calculate how much annual tax a citizen owes to the government.

A program that performs the above must satisfy the following requirements.

REQ1: A user must be prompted to input data in the correct format. This is the annual salary of one or more citizens. If the data is incorrect, then the user must be prompted to re-enter the data. The user must be able to tell the program that data entry has finished.

REQ2. The program must be able to perform the calculations as identified above and to inform the user of the results.

Write an algorithm based on the above description that satisfies the requirements REQ1 and REQ2. When you have written your algorithm, discuss exactly how your algorithm satisfies these requirements. Any interaction with a user can be represented as appropriate display messages. **(20 Marks)**

- (b) Define the behaviour of the logical operator OR. Discuss how this is used in a program to choose between different conditions in an IF statement. Use an example to illustrate your discussion. **(10 marks)**
- (c) A test plan is typically made to demonstrate that a program satisfies a set of requirements. Write a test plan with expected outcomes for each of the requirements REQ1 and REQ2. **(10 marks)**

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2. (a) A perfume manufacturer is about to produce two new perfumes. However, before they can begin, they need to know which! The manufacturer surveyed 500 people on their reactions to four new perfumes. Each person was asked to rate each perfume on a score of 1 (really bad) to 10 (really good). Based on this data, the manufacturer now needs to know which two to produce! A program is required that allows data to be entered from the survey. The program then needs to be able to output the four overall scores and identify the best two.

REQ1: A user must be prompted to input data in the correct format. This is the data from the survey from the 500 people. If the data is incorrect, then the user must be prompted to re-enter the data. The user must be able to tell the program that data entry has finished.

REQ2. The program must be able to perform the calculations as identified above and to inform the user of the results.

Write an algorithm based on the above description that satisfies the requirements REQ1 and REQ2. When you have written your algorithm, discuss exactly how your algorithm satisfies these requirements. Any interaction with a user can be represented as appropriate display messages. **(20 Marks)**

- (b) Parameters can be passed to procedures by values or by reference. Using one example for each approach, discuss in what situations you would use each approach. **(10 marks)**
- (c) A test plan is typically made to demonstrate that a program satisfies a set of requirements. Write a test plan with expected outcomes for each of the requirements REQ1 and REQ2. **(10 marks)**

SECTION B: Databases

If this is one of the two sections you choose, answer **two** questions from it (20 marks each).

- 3 (a) Normalize Branch/Staff table below to the Third Normal Form, clearly showing the table(s) in the First Normal Form, Second Normal Form and Third Normal Form. Indicate your choice of primary and foreign keys (e.g. single underline primary keys and double underline foreign keys) in each table. Please note that mgrNo refers to the unique branch manager number, mgrName refers to branch manager name and HoursPerWeek refers to hours per week worked by each member of staff (excluding the manager). The primary key for Branch/Staff table is composed of StaffNo and BranchNo. **(15 marks)**

<u>Staff No</u>	<u>Branch No</u>	branch Address	telNo	mgrNo	mgrName	staffName	Hours Per Week
S4555	B002	City Center Seattle	503-555-3618, 503-555-2727	S1500	T Daniel	E Layman	16
S4555	B004	16 Avenue, Seattle	206-555-3131, 206-555-4112	S0010	M Martin	E Layman	9
S4612	B002	City Center Seattle	503-555-3618, 503-555-2727	S1500	T Daniel	D Sinclair	14
S4612	B004	16 Avenue, Seattle	206-555-3131, 206-555-4112	S0010	M Martin	D Sinclair	10

- (b) Explain what happens when a user accesses a database through a view. **(5 marks)**

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4. (a) List the main types of threat that could affect a database system. **(8 marks)**
- (b) Define commit and rollback transactions and explain, with an illustrative example, their purpose. **(7 marks)**
- (c) Discuss an approach to identifying entities and relationships from a users' requirements specification. **(5 marks)**
5. (a) Using the database tables below express the following queries in SQL. The primary keys are underlined.

Table	Attributes
Hotel	<u>hotelNo</u> , name, address
Room	<u>roomNo</u> , <u>hotelNo</u> , type, price
Booking	<u>hotelNo</u> , <u>guestNo</u> , <u>dateFrom</u> , dateTo, roomNo
Guest	<u>guestNo</u> , name, address

- i. What is the average price of a room? **(4 marks)**
- ii. List rooms with a price below 40.00 per night, in ascending order of price. **(5 marks)**
- iii. List all guests (their guestNo and name) currently staying at the Grosvenor Hotel. **(9 marks)**
- (b) What is the purpose of primary keys? **(2 marks)**

SECTION C: Networking: intranets and the Internet

If this is one of the two sections you choose, answer **two** questions from it (20 marks each).

6. (a) Define the term **connectionless protocol** as used in computer networks. **(4 marks)**

 (b) Describe the four major steps involved in sending an electronic mail from one networked computer to another residing on a different network. **(16 marks)**

7. (a) Describe the functions that repeaters and switches respectively perform in Local Area Networks (LANs). What are the main differences in functionality between the two devices? **(9 marks)**

 (b) The bus and ring LAN topologies are two examples of possible LAN configurations. Describe them, highlighting their comparative merits. Illustrate your answer with diagrams. **(11 marks)**

8. (a) Describe the role of a routing table in communication networks. **(4 marks)**

 (b) Highlight what, in your opinion, are the main differences, as well as the common characteristics, of Local Area Networks and Wide Area Networks, respectively. Treat issues such as connectivity, protocols, topologies and routing in your reply, but note that marks will also be awarded for other valid points that you might want to make. **(16 marks)**

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SECTION D: Human Computer Interaction

If this is one of the two sections you choose, answer **two** questions from it (20 marks each).

9. (a) Describe the critical features of an interactive system, and the role that interactive systems can play in supporting human activities. **(10 marks)**
- (b) Discuss the following statement: 'HCI is a science that is used to support novice users in making effective use of computer systems'. You will need to address if and why this is a limited definition, and how the statement might be improved. **(10 marks)**
10. (a) Mental models are a powerful approach to developing interface designs. Discuss their role in human cognitive behaviour and show how they can be applied to support interactive systems design. **(10 marks)**
- (b) There are a variety of techniques that we can use to support users learn to use interactive systems. Describe 5 of these and briefly illustrate how these might be applied, where possible use examples from your reading or you own experience in using computer systems. **(10 marks)**
11. **Scenario:** You have been asked to design the interface to an interactive system; this will be a 'science workbench' for use by students at school between the ages of 14-18. This system will involve the design of a series of networked screens that will report on the results of experiments: what is entered on one screen will be visible on others. Students in different schools will be able to enter the results of their ongoing experiments on these screens through wireless keyboards and mice associated with their screen. Teachers will have administrator access and be able to manage these screens to 'undo' any mistakes, delete material, and save the results to file.

Question: From an HCI perspective (i.e. without detailing the networking, security, programming or commercial considerations), describe the factors that you would have to consider in the design. Clearly justify your answers.

Marks will be awarded equally between your designs, for the application of HCI knowledge, and for the application of an appropriate HCI design approach. **(20 marks)**

END OF PAPER