

**OLLSCOIL NA hÉIREANN**  
**NATIONAL UNIVERSITY OF IRELAND, GALWAY**

**SEMESTER II, SUMMER 2000 EXAMINATION**

Second B.Sc. in Information Technology

***Repeat Examination - Software Engineering I (CT216)***

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**Time Allowed: 3 hours**

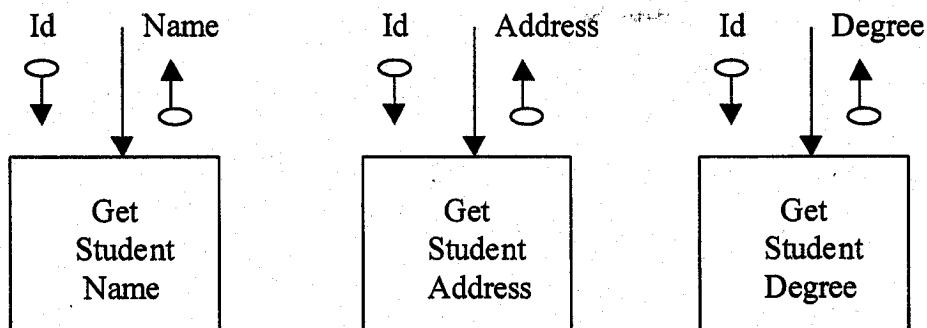
Answer any five questions.

Use a separate answer book for each section

**Section A: Structured Techniques**

1. (a) Explain the terms *Factoring*, *Fan In*, and *Fan Out*.

(b) The routines *Get Student Name*, *Get Student Address* and *Get Student Degree* are used as part of a student information system. Each routine must access a persistent data source to retrieve information. However, accessing the persistent data source (three times) has presented a performance problem. Show how an information cluster can be used to improve performance. Comment on the coupling and cohesion levels of the new design.



2. Based on the activities of Compu Corp., develop:

- An event list
- A preliminary behavioural model
- A completed behavioural model

**Customers** place orders for computers. If they have already done business with the company, they are asked for their unique CUSTOMER-NUMBER. If they are a new customer, their details will be recorded, including: NAME, ADDRESS, PHONE-NUMBER, and a unique CUSTOMER-NUMBER will be assigned to them. Once they have a CUSTOMER-NUMBER, details of their order are recorded. These include the PRODUCT-ID and QUANTITY. The PRODUCT-ID is cross-checked against the PRODUCTS data store to ensure that it exists. The customer order is then stored, and the ORDER-STATUS is set to "Pending."

At the end of each working day, a BUILD-PLAN is generated and sent to the **Production Control System**. The BUILD-PLAN is a list of all those orders whose status is "Pending." When an order is added to the BUILD-PLAN, it's ORDER-STATUS is modified to "Released."

Frequently, the PRODUCTS data store is updated with new information from the **Materials Planning System**, which modifies or adds information on the company's products.

At the end of each working day, the **Production Control System** provides updates as to the status of each order. The status can be one of "Queuing", "40% Complete", "70% Complete", "Finished" or "Sent."

At the end of each month, Management request a STATUS-REPORT which is based on information from the ORDERS and the PRODUCTS.

3. The table below contains sample data for parts and for vendors who supply those parts. In discussing this data with users, we find that part numbers (but not descriptions) uniquely identify parts, and that vendor names uniquely identify vendors. Identify functional dependencies and convert the table to 3NF.

PART NO	DESCRIPTI ON	VENDOR NAME	ADDRESS	UNIT COST
1234	Logic Chip	Fast Chips	Cupertino	10.00
		Smart Chips	Pheonix	8.00
5678	Memory Chip	Fast Chips	Cupertino	3.00
		Quality Chips	Austin	2.00
		Smart Chips	Pheonix	5.00

4. (a) Explain the terms: Functional Dependency; Second Normal Form; Third Normal Form.

(b) Identify functional dependencies in the following relation. Convert the relation to Third Normal Form (3NF).

Student ID	Name	Degree	Result	Subject	Title
98765433	J. Murphy	BA	56	CT111	Programming
98765433	J. Murphy	BA	78	IT118	Italian
98744411	M. Ruane	BSC	65	CT111	Programming
98744411	M. Ruane	BSC	71	IT118	Italian

5. (a) Describe:

- Stamp Coupling
- Sequential Cohesion
- Communicational Cohesion

(b) Using appropriate measures, determine the quality of the routine *Process Array*. If appropriate, redesign the routine so that it conforms to best design practice.

**Routine:** Process Array  
**Uses:** Flag, List, N  
**Returns:** Min, Max

```
Begin
    Integer j;

    If(Flag == 1){
        Min = List[0];
        For(j=1; j < N; j++)
            If(Min > List[j])
                Min = List[j];
        Return Min;
    }
    else if (Flag == 2){
        Max = List[0];
        For(j=1; j < N; j++)
            If(Max < List[j])
                Max = List[j];
        Return Max;
    }
}
```

End

6. (a) For each of the following entities and relationships, show the entity sets (with sample entity instances), and draw E-R models with cardinalities.

- A Student can study more than one subject. A subject is taken by one or more students.
- A person can manage one or more people. Each person can only have one manager.

(b) Study the problem description (Fantasy Football) and construct an E-R model.

An Owner can have one or more Teams. Owners are uniquely identified by an Owner Id, and have attributes Name and E-Mail Address. Each Team has a unique Team Id, Team Name and Total Value. Teams consist of many players, and each player can belong to more than one team. Players are uniquely identified by a Player ID, and have further attribute information, namely: Name, Club and Value. For each player, their points value for every week of competition must be stored.

### **Section B: Formal Methods**

7. Model the booking system for a particular flight. The aeroplane has a limited capacity and the flight should not be overbooked. The operations should include: a passenger booking onto the flight; a passenger cancelling his booking; a query of how many seats are still available; the production of a passenger list. (Hint: Use the given set [PERSON]).
8. Develop a Z specification of a (single) bank account. You should include operations to make a deposit and to make a withdrawal. Any amount can be deposited, but a withdrawal should not allow the account to go overdrawn.