UNIVERSITY OF TORONTO

FACULTY OF APPLIED SCIENCE AND ENGINEERING

FINAL EXAMINATION, DECEMBER 2001

Third Year - Program: Industrial (Systems) Engineering
Fourth Year - Program: Engineering Science - Manufacturing Systems

MIE350F - DESIGN & ANALYSIS OF INFORMATION SYSTEMS

Exam Type: A

Examiner - C. D. Sadleir

NOTE: ALL responses are to be provided in your answer book.
Please do not respond on the question sheet.

Part A: Completion

Please write the word or phrase(s) required to complete the following statements **in your answer book and number your responses carefully**. Each is worth 1/2 mark.

1. Decision types that are currently resistant to computerization and depend primarily on judgement and intuition are called _____ decisions.

2. Decisions which assume we are somewhat knowledgeable about alternatives and for which we can estimate probabilities are said to be taken under conditions of _____.

3. The reason the game of tic-tac-toe probably appears unstructured to a five-year old is due to his/her relative _____.

4. One key descriptor that must be known in order to 'mechanize' structured decisions is _____.

5. The value attributed to the impact of a failed system on the enterprise's reputation is called an _____ cost.

6. The purpose of a joint application design (JAD) session is to obtain _____ simultaneously and more quickly.

7. The purpose of a structured walk-through is to obtain _____ from another viewpoint.

8. One advantage of using a prototype approach in systems development is _____ .

9. One key risk associated with the use of prototypes is _____ .

10. One of the many different methods available to document process logic is _____ .

11. A major advantage of decision tables over other methods is that such tables help the analyst to ensure _____.

12. When portrayal of the sequence of conditions and actions is critical, use of a _____ is an effective documentation approach.

13. The highest level data flow diagram is called a _____ diagram.

14. A reference work of data about data elements is called a _____ .

15. An alternative to building sequential computer-based files is to create a _____.

16. One sorting approach that can introduce bias into information is _____ .

17. An appropriate chart/graphic to illustrate "% of the whole" relationships is called a ____ chart.

18. A report which is generated on the basis of deviations from acceptable ranges is called an _____ report.

19. A document that serves as both output and input is called a _____ document.

20. User interface design should consider the needs of 2 generic types of users. Name one type.

21. One user interface design goal common to both user types is _____ .

22. Displaying 'help' about the particular operation the user is trying to perform is called _____ help.

23. One example of feedback that the computer program should provide to the data entry person is _____ .

24. A command language approach for user input has the advantage of being _____.

25. A command language approach for user input has the disadvantage of being _____.

26. To automatically detect that the number 12235 was not incorrectly typed as 12325, the designer would use a technique called _____.

27. One major problem or error that can occur with input transactions is _____.

28. An input method useful for speeding up the scoring of answer sheets for survey questionnaires is _____.

29. A code which is used to conceal or disguise the meaning of a data element is called a _____ code.

30. One objective of a well designed input form or screen is _____.

31. A data element that is created by a process or formula is called a _____ element.

32. One automatic test for input data element validity is _____ .

33. One example of logical security control is _____ .

34. A network which serves users connected on a single floor is called a _____.

[17]

Part B. Analysis

B1. Soporific Inc. is a large pharmaceutical company with six major organizational groups. Each of these six groups has departments which use, in turn, one or more business processes to conduct their activities. An external systems analyst has been engaged to document and assess all of these processes as a first step in a major re-engineering project.

By the end of the first week, the analyst had examined only one of the six major groups, namely, the Clinical Trials group which has 3 departments; Trial Design, Trial Operation, and Regulatory Compliance. The analyst learned that each of these departments has several processes but had examined only 2 of the 4 processes in the Trial Design department, namely, Trial Selection and Trial Administration.

Draw the Functional Decomposition Diagram which reflects **all** of the information provided in the above description. Use standard symbols and label all aspects accurately. **[6]**

B2. Soporific Inc. has a mobile sales force who work out of their home offices and routinely communicate by mobile phone and fax with the Purchasing Departments of assigned hospitals in order to promote new drugs and maintain customer relationships. They also visit hospitals about once every quarter; are in frequent communication with the shipping agents in the Soporific warehouse and, on occasion, with the Soporific accounting office. There are 5 salespeople serving the Greater Toronto Area (GTA).

Hospital purchasing departments place orders for drugs electronically on the Soporific warehouse located adjacent to the manufacturing operation in Mississauga, Ontario. Two shipping agents in the warehouse office review the orders on-line, add various descriptive codes and then transmit completed orders on-line to stock pickers in the warehouse. The stock pickers prepare the shipments and send a confirmation electronically to the accounting office staff located in the Soporific head office in downtown Toronto. The accounting office, in turn, creates invoices on-line and transmits these to the respective hospitals for payment.

Analysts have not yet had time to study network traffic patterns or volumes. Their assessment of the distances involved is also incomplete but they have noted that the maximum distance for the LAN from the shipping agents to the stock pickers is 500 meters; the head office is approximately 20 km from the warehouse; and the distances from hospitals to the warehouse and between sales force members and either the warehouse or a given hospital are highly variable. However, in the GTA, the maximum distance between a hospital and the warehouse or between a hospital and the accounting office is 80 km. The maximum distance between a salesperson and the warehouse or between a salesperson and the accounting office is 110 km.

Draw a preliminary, high level Location-Connectivity diagram that reflects the above scenario for the GTA. Use the symbols provided and label your diagram completely. **[9]**

B3. Draw and clearly label a Decision Tree that reflects the Reams Inc. discounting policy described below. [5]

Reams Inc. is an office supply company that allows established customers to place orders for products and supplies by telephone, fax or via the company web site and then pay for the delivered items after the fact. The company sends out invoices weekly to these customers and, to encourage prompt payment, offers discounts under certain conditions. Their discounting policy is as follows:

> Discounts will not apply to Special Orders of any kind received via any medium;
> Discounts will not apply if payment is received after 10 days;
> If the current invoice amount is greater than $1000, apply a 4% discount;
> If the current invoice amount is $500 to $1000, inclusive, apply a 2% discount;
> If the current invoice amount is less than $500, apply no initial discount;
> For qualifying orders received via the web site, apply an extra 5% discount.

B4. Create the related Decision Table for the Reams Inc. discounting policy described above. [7]

B5. Reams Inc. have an old, highly reliable billing system which is operated in a 'batch' mode on a central computer. All the staff involved with this system are familiar with it; most are cross-trained on several functions in order to ensure back-up when colleagues are ill or on vacation. Data from telephone and fax orders along with data from payments received are entered into the computer at set intervals each day (after shipments are prepared) and the accounts receivable master file is updated overnight. The cheques received are deposited in the bank at the end of each business day. Invoices are generated at the end of each week in a 'turnaround' document format and mailed to customers. Orders received on the recently implemented web site are printed out (when received) as a 'picking slip' which is first used to fill the order and then processed in the same way as the telephone and fax orders.

Reams Inc. management are considering various systems changes including a change to on-line, real-time data entry for all of their orders (telephone, fax, web) as well as for payment processing. They have requested a Feasibility Report from their senior systems analyst.

For each of the following topics, briefly identify whether the new approach proposed (on-line, real-time data entry) could have positive or negative impact and why. [You may respond using point form]

a. Input data validation [4]

b. Web site order process [4]

c. Overall system implementation [4]

Part C. Design

C1. Two engineering students decided to start a new service-based business on the Internet that would provide potential home buyers with the ability to enter their requirements on-line and have these matched up with descriptions of homes for sale provided by sellers and receive a potential purchases listing. They decided to call this a "Home Finder System". As part of their preliminary design, they determined that two databases would be needed; Home Master file (D1) to contain records of homes for sale and a Requirements Master file (D2) to contain records of the preferences of potential buyers.

After considering various approaches to designing the logic of the web site, they determined that four processes would be needed;

1. Create Home Master record
2. Create Requirements record
3. Match Requirements to Homes
4. Display Potential Homes listing

The Home Master record is created from the Home Information provided by the seller and a record in the Requirements Master file is created from Requirements Information provided by the potential buyer. The Match Requirements to Homes process uses the variables in the Requirements record to search the Home Master file and extract records that meet the search criteria. These records, called Potential Homes, are passed to the Display Potential Homes listing process for display as a detailed list for the potential buyer.

Draw the Context Level diagram for the "Home Finder System" described above. **[4]**

C2. Draw the logical Level 0 diagram for the "Home Finder System" described above. **[8]**

NOTE: in each case above, use only the identifying labels provided in the description and use the standard symbols provided.

C3. In the Home Finder System described above in C1, the following are some of the data elements in the Home Master file record which convey the following kinds of information; a unique identification number for each home (UID), a style code (STC), total area (TAR), number of bedrooms (BEDS), number of bathrooms (BATHS), a garage type code (GTC), heating system type code (HST), air conditioning type code (ACT), selling price (SPR).

For the data elements listed above, write the Data Structure definition for the record using appropriate algebraic symbols and the short-form name given in ( ) beside each. **[3]**

C4. The designers expect there could be up to 10,000 records in the Home Master file at any one time. They decided that descriptive codes would be alphanumeric and require 2 characters. The size of other fields were determined by the nature of their contents. Given these decisions, create the following table for all the data elements in your Data Structure definition above. **[5]**

Data Element Name	Length (Number of Characters)	Base or Derived (B or D)	Output Format

C5. One of the data elements listed in the opening problem statement (C3.above) is not sufficiently described. Which one is it and what information is missing ? **[2]**

C6. Apart from the choices required in selecting the necessary underlying technology (e.g., the databases and search capabilities), the designers of the Home Finder System need to consider various aspects of the user interface in order for their web based system to be successful. They include "making a profit" as part of their definition of success.

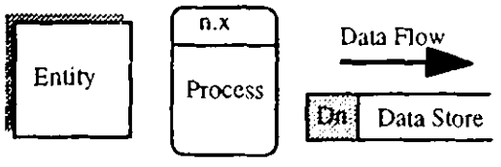
a. Suggest one way in which they might generate revenue for their service. [3]

b. Briefly, describe important dimensions of the user interface that should be considered by the designers of this web based service. In doing so, please attempt to relate your views to the specific nature of the service described (e.g., functionality, purpose, required user interaction, etc.) [9]

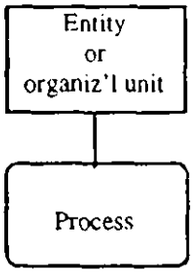
Total Marks = 90

Reference Symbols:

Data Flow Diagram (DFD)



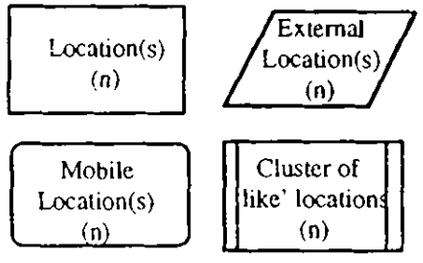
Functional Decomposition Diagram (FDD)



Data Structure Algebra

=	is composed of
+	and
$\overset{n}{1}\{\ \}$	repeating: from 1 to n times
( )	optional
[a : b]	either a or b; not both

Location-Connectivity Diagram (LCD)



communication link
(distance)

Note: adding 'sidebars' | | to any symbol signifies a cluster

Decision Tree Diagrams