University of Swaziland

Department of Computer Science
Final Examination 2006/2007

Title of paper : Software Engineering I

Course number : CS451/CS461

Time Allowed : Three(3) hours

Instructions :

- ***Each question is worth 25 marks***
- ***Answer Question 1***
- ***Answer any three(3) questions from questions 2 to 6***

This paper may not be opened until permission has been granted by the invigilator

Question 1 - compulsory

Described below is the operation of ***Computer Books by Mail (CBM) system***

(a) Draw a context diagram for ***Computer Books by Mail (CBM) system*** .

5 marks

(b) Draw a top-level (level 1) logical data flow diagram for CBM.

20 marks

The Computer Books by Mail (CBM) System.

Orders will be received by mail, or taken over the phone. Phone orders will be taken down in a standard form, or entered directly into a CTR using a standard format. Each order will be scanned to see that all important information is present, that the title exists (or can be identified), that the author is correct (or can be identified), and that the book is available (i.e., not out of print). If the order is defective, it is routed out to a supervisor to see if, for example, "The Programming of Management," by Doe Jane, should rather be "Management of programming," by Jane Doe. If the order includes payment, the amount should be checked for correctness (if not correct, a request for further payment or a credit should be produced). Small discrepancies can be ignored. Where payment is not with the order, the customer file must be checked to see if the order comes from a person or organization in good credit standing; if not, the customer must be sent confirmation of the order and a request for prepayment. If the customer is new to us, an addition must be made to the customer file.

If an order is with payment or has good credit, an inventory is checked to see if the order can be filled. If it can, a shipping note with an invoice (marked "paid" for prepaid orders), is prepared and sent out with the books. If the order can only be part-filled, a shipping note and invoice is prepared for the part shipment, with a confirmation of the unfilled part (and paid invoice where payment was sent with the order), and a back-order record is created. Back orders are to be filled as soon as the books are received from the publisher. Orders for books not held in inventory are batched for purchase requisition on the publisher when a quantity discount has been earned. Returned books are examined for

damage, and entered back into stock, with a credit or refund being issued to the customer as appropriate. Where the returned book is not an inventory item, and the publisher allows returns, it is sent back to the publisher.

When a shipment of books is received from a publisher, its contents are to be checked against the original purchase order, and the discrepancies queried. The titles in the shipment are checked against the back orders for priority shipment; and the remainder entered into inventory. Inventory control policy calls for a reorder level on each title equal to the (average orders over the previous four weeks) x (delivery times from publishers) plus a 50% safety factor. Thus if sales of a title average 10 per week and the estimated delivery time is 3 weeks, an order will be placed with the publisher when the total copies in hand (and on order) have fallen to 45 (3 x 10 x 150%). The safety factor may be varied from time to time by management, being increased for titles whose sales are rising and vice versa. The quantity for each order is determined by taking the product of the average order rate and delivery time, as above, multiplying by a bulk factor (normally 3), and rounding up to the next higher break point. unless that increases the order by more than 25%. Thus in the case above, the normal order would be 3 x 10 x 3 (bulk factor) or 90 copies. If the publisher offers additional discount for orders of 100 or more, 100 copies would be ordered. If the discount is only offered for 120 or more, 90 would be ordered, since to order 120 would increase the order by the excessive amount of 33%. The bulk factor may be varied by management for each title from time to time. The calculation of average order rate includes not only orders that were filled, but frustrated demand, such as back orders, orders without payment, and inquiries that were not converted to orders because the book could not be supplied from stock.

When payments for books supplied are received, they are matched with appropriate invoice. Where several invoices are outstanding for an account, and the payment does not match anyone of them exactly, it is applied to the oldest invoice first. Frequently a customer will send one payment to cover several invoices. Where any invoice is more than 30 days overdue, a statement of all invoices outstanding is sent to the customer. When any invoice is more than 60 days overdue, a strongly worded letter is produced for the vice-President's signature.

When invoices are received from the publishers, they are checked against the receipt-of-shipment records, and entered into accounts payable. If the discount for prompt payment given by the publisher exceeds, on an annualized basis, the marginal cost of funds (as. specified from time to time by management), the system should produce a payment cheque on the last day the discount is available. For example, if 2.5% discount is offered for payment in 30 days, this is equivalent to 30% per year. The system should write a cheque on day 29 of the month.

Reports of invoices sent out, by day, by week, by month, payments received by day, week, month, amounts overdue by various periods, stock-outs, back orders, and purchases from publishers, should all be produced regularly. On demand analyses of sales by title, by subject, by publisher, with trend information, should be available on an immediate basis, together with information on publisher delivery times and purchasing trends. Immediate access to inventory figures of quantity-on-hand, quantity-on-order, and expected date of delivery are all very desirable, as is the facility to give a customer immediate information as to the status of his particular order. If a customer calls up and says. 'I sent you a cheque for $10 five weeks ago, for Hardy's book.', we would like to be able tell him what day we shipped the book to him, or on what day we will be able to ship it.

Question 2

(a) List and Explain five (5) dimensions along which a software development project has to be controlled. *5 marks*

(b) Describe the main difference between incremental development and Rapid Application Development (RAD) *3 marks*

(c) Discuss the main contents of a project plan. *3 marks*

(d) Consider the following project schedule.

	Activity	**Predecessor**	**Duration** *(days)*	**Cost** *(E/ day)*
Develop plan for adverts.	A	NONE	2	1000
Design promotion plan.	B	NONE	2	700
Develop training plan.	C	NONE	2	800
Schedule radio and T.V. adverts.	D	A	3	500
Prepare adverts.	E	A	8	800
Prepare material for promotion.	F	B	7	600
Prepare manual for training.	G	B	5	600
Conduct pre-introduction campaign	H	D	4	400
Screen and select managers.	I	C	7	800
Conduct training program	J	G & I	3	1000
Introduce system	K	E & F	4	1200
Evaluate system	L	H & J & K	3	1000

(i) Draw a Gantt chart for above project plan. *5 marks*

(ii)Draw a PERT diagram for above project plan. *5 marks*

(iii)What is the earliest completion time for the project? *1 mark*

(iv)What is the critical path of the project? *1 mark*

(v)What is the additional cost to the project if task C was delayed by 5 days? *2 marks*

Question 3

(a) What is the general purpose of Normalization? *2 marks*

(b) Using Armstrong's axioms, state and prove the correctness of the **decomposition rule.** *3 marks*

(c) Consider the following STUDENT CARD containing information about each student and the course the student enrolled in.

STUDENT CARD			
Course ID#: *CS449*		**Course Name:** *Software Engineering*	
ENROLLMENT			
Sid	**Name**	**Address**	**Grade**
101010	*Musa Zulu*	*P.O. Box 9 Manzini*	*78*
121201	*Keith James*	*Private Bag , Kwaluseni*	*55*
1114545	*Sipho Thusi*	*P.O. Box 21 Matsapha*	*39*
15152021	*kate Davids*	*P.O. Box 23 Piggs Peak*	*65*

Describe the data contained in the student card in *Unnormalized form, First normal form, Second normal form* and *Third normal form* relations. *20 marks*

Question 4

The following narrative is the procedure used by Vusi Insurance Company for calculating the insurance premium for a car driver.

Young drivers, that is anyone less than 25 years, are most likely to be involved in an accident. The riskiest cars are sports cars. Any driver with a license endorsement is twice as likely to have a claim as one with a clean license. So we set our premiums accordingly as follows:
A young sports-car driver with a clean license with be charged 30% over the standard rate. An older sports-car driver with a clean license with be charged 10% over the standard rate. A sports-car driver with a license endorsement pays a surcharge of 20% if he or she is old, and just refused cover if otherwise – we won't cover them at all. A young saloon-car driver with an endorsement pays 20% extra and an older saloon-car driver with a clean license pays no surcharge on the standard rate. All other cases pay a 10% surcharge.

a) Draw a decision tree for the premium calculation system as explained above. *12 Marks*

b) Draw a decision table for the premium calculation system as explained above. *13 Marks*

Question 5

DATABASE FOR VEHICLE AND RENTAL SYSTEM

A car firm maintains a database to record details of its fleet of vehicles (cars and vans), and its hire transactions. For each car or van the details recorded include a unique registration number, make, model, engine capacity and date of registration. The record for each car also includes the style of the car (saloon, hatch back, etc) and the number of doors. Additional information recorded for each van include its carrying capacity (in cubic meters) and its maximum load (in tones). Each car or van has a service history which records the service date, service mileage and the vendor (garage) that serviced the vehicle.

Each time a vehicle is hired the name, address, telephone number and license number of the customer are entered into the database, together with the identification of the vehicle which has been hired. The dates and times of the beginning and end of the hire period are also recorded, as well as the number of kilometers covered by the customer and the total cost of the hire. For each model of vehicle the daily, weekly and monthly hire rate are stored. The hire rates vary from model to model.

a) Draw an Entity-Relationship (ER) diagram for the vehicle rental system as described above.

10 Marks

b) Write a data dictionary based on the ER diagram obtained in (a) above.

5 Marks

c) Convert the ER diagram obtained in (a) above into a set of tables.

10 Marks