UNIVERSITY OF LONDON
IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE

EXAMINATIONS 2000

BEng Honours Degree in Computing Part II
MEng Honours Degrees in Computing Part II
BEng Honours Degree in Mathematics and Computer Science Part II
MEng Honours Degree in Mathematics and Computer Science Part II
for Internal Students of the Imperial College of Science, Technology and Medicine

This paper is also taken for the relevant examinations for the Associateship of the City and Guilds of London Institute
This paper is also taken for the relevant examinations for the Associateship of the Royal College of Science

PAPER C222=MC222

SOFTWARE ENGINEERING - DESIGN II

Monday 15 May 2000, 16:00
Duration: 90 minutes
(Reading time 5 minutes)

Answer THREE questions

Paper contains 4 questions

Section A *(Use a separate answer book for this Section)*

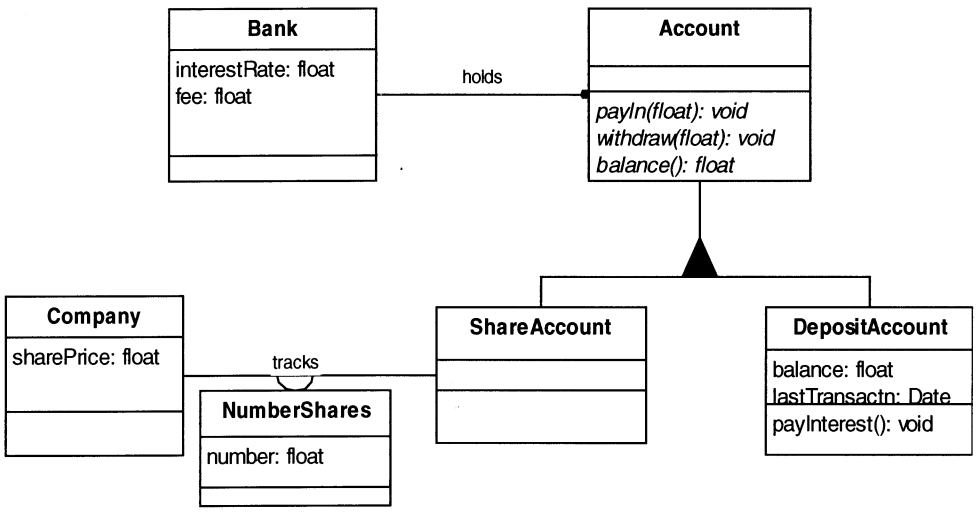
1 Consider the following simplified description of bank accounts:

A *bank* has a name, a daily interest rate, and a fee charged upon some transactions. Daily interest rates and fees may change. Banks hold deposit accounts and share accounts.

Deposit accounts have a balance. When an amount is paid into a deposit account, first the amount is reduced by the bank's fee, then interest is added to the balance, and finally the balance is increased by the (reduced) amount. When an amount is withdrawn from a deposit account, first the amount is increased by the bank's fee, then interest is added to the balance, and finally the balance is decreased by the (increased) amount. The interest is the product of the number of days from the most recent transaction until the current transaction, the interest rate of the holding bank, and the balance. The balance of a deposit account may be enquired.

Share accounts hold a (floating point) number of shares of a company. *Companies* have a share price, which may change. When an amount is paid into a share account, first the amount is reduced by the bank's fee, and then the number of shares is increased by the (reduced) amount divided by the company's share price. When an amount is withdrawn from a share account, first the amount is increased by the bank's fee, and then the number of shares is decreased by the (increased) amount divided by the company's share price. The balance of a share account is the number of shares multiplied by the share's price.

The following OMT object model class diagram outlines accounts:



a Write Java classes (i.e. declarations and function bodies) to support the above.

For the representation of dates use a class `Date` defined as follows:

```
class Date{
    public Date(int day, int month, int year) { ... }
    public int daysUntil(Date aDate) { ... }
    // returns number of days between receiver and aDate
    public static void setTodaysDate(Date aDate) { ... }
    // sets today's date to aDate
```

```
public static Date getTodaysDate( ) { ... }
// return today's date
. . . };
```

b Write a test function that:

i) creates two banks: the NEB, "NatEast Bank" with a daily interest rate of 0.0030 and a fee of 3.3, and the BW, "Bank of Wales" with an interest rate of 0.0040 and a fee of 2.2;

ii) sets today to the 25th May 1990;

iii) creates A1, a deposit account with the NEB, and initial balance of 5000.00;

iv) creates BT, a new company with a price of 60.0; and A2, a share account with the NEB, holding shares of BT; pays 444.44 into A2;

v) sets today to the 25th May 2000; pays 33.33 into A1; sets the price of BT at 40.40; pays 44.44 into A2; and enquires the balance of A1 and of A2.

The two parts carry, respectively, 70%, 30% of the marks.

2 Consider the following aspects of airline flight bookings:

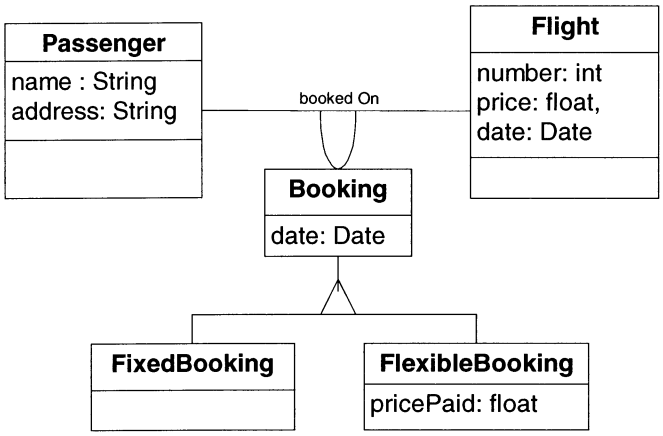
A *flight* has a code number, a date and a price.

A *passenger* has a name and an address. A passenger may be booked on one or more flights.

There are *firm bookings*, where the whole price of the flight has been paid, and *flexible bookings*, where only a deposit (smaller than the flight price) has been paid. A flexible booking may be cancelled up to 10 days before the date of the flight, and then 80% of the deposit paid will be returned. A firm booking may only be cancelled up to 20 days before the date of the flight, but then the complete flight price will be returned.

Information about a flight may be printed: The flight number, and date are printed, followed by the name, address and the outstanding amount (*i.e.* price of flight) for each of the passengers booked.

The following OMT object model class diagram outlines flight bookings:



a Write Java classes to implement the above. Do *not* give the bodies of the functions, but *do* indicate which functions are abstract.

You may assume a class Date defined as follows:

```
class Date{
    Date(int day, int month, int year) { . . . }
    int daysUntil(Date aDate){ . . . }
    // returns number of days between receiver and aDate
    . . . };
```

b Write a test function with:

i) F1, a flight with code 555 to take place on the 15th February 2000 and which costs 560 pounds, and a flight F2, with code 888 to take place on the 15th March 2000 and costing 780 pounds,

ii) a passenger Mr Smiley, living on 23 Humour Street, with a fixed booking on F1,

iii) a passenger Miss Grumpy, living on 44 Complaints Avenue, with a flexible booking F1, having paid 400 pounds, and also with a fixed booking on F2,

iv) information about F1 to be printed,

v) on the 15th January Miss Smiley cancels her booking on F1.

The two parts carry, respectively, 80%, 20% of the marks.

Section B *(Use a separate answer book for this Section)*

3a Briefly describe the main features and resulting benefits of each of the following three approaches to incorporating the user in the design process:

i) Usability Engineering

ii) Design Rationale

iii) Participatory Design

b State and justify the aspects of each approach in part *a* that you would select for the following scenario:

You work for an IT department of a multinational engineering & manufacturing corporation. A specialist design unit of 12 people who work closely together and have done so for several years want some software to aid communication of designs between them and to store those designs for re-use. The tool will not be used outside this close group within your company although it will have to be maintained by you. This group is key to your company's business profitability.

c State and justify the aspects of each approach in part *a* that you would select for the following scenario:

You work in a small IT design and development house. A large toy manufacturer has commissioned a contract with you to produce an educational toy for 5 to 7 year olds to help them learn to read. The toy company knows that the demographics of the parents who would buy the product form a near global English speaking mass market. The company wishes to compete in this market, but competition from 3 other companies will limit product price. If the product is successful, future products will be required for other languages, and for other age groups, while maintaining a clear corporate image.

The three parts carry, respectively, 40%, 30%, and 30% of the marks.

4a The following performance times are given for a user population:

Tk = 0.2s; Tp = 1.1s; Th = 0.4s; Td = $0.9n_D$ * $0.16l_D$; Tm = 1.35s; Tr = t

Use the keystroke level model to predict performance times for the command to replace a word in a keyboard command line text editor, where the command string to issue is:

<LF> S cats <CR> dogs <CR> <CR>

White space is for readability only and is not part of the command.
Your answer should make your reasoning clear.

b Briefly describe the processes available for evaluating an unimplemented design for a publicly accessible web site of school performance tables. What would be the product of the evaluation, and what would be its function?

c Briefly explain the purpose of task analysis in user interface design, and how it contributes to dialogue design.

d Construct a simple outline hierarchical task chart for the maintenance of a web site such as the school performance tables in part *b* above, and hence suggest the interface architecture for a tool to maintain the web site.

The four parts carry, respectively 20%, 20%, 20%, and 40% of the marks