Victorian Certificate of Education
1998

INFORMATION SYSTEMS

Common Assessment Task 3: Written examination

Thursday 12 November 1998: 11.45 am to 2.00 pm
Reading time: 11.45 am to 12 noon
Writing time: 12 noon to 2.00 pm
Total writing time: 2 hours

QUESTION BOOK

Structure of book

Number of questions	*Number of questions to be answered*
9	9

Directions to students

Materials
Question book of 8 pages.
One or more script books.
An approved calculator may be used.

The task
Please ensure that you write your **student number** in the space provided on the front cover of the script book(s).
This question book contains only one case study. Answer **all** questions in the script book(s) provided.
Students should answer **either** Part A **or** Part B in Question 9. All questions are of equal value.
All written responses should be in English.

At the end of the task
Place all other script books inside the front cover of one of the used script books.
You may retain this question book.

CASE STUDY

Dairy System

The existing milking system

Robert Holstein is a new graduate from Brookie Agricultural College. He recently bought a dairy farm in Western Victoria with a herd of 230 cows.

The cows are milked twice a day in a 32-stall rotary milking shed. As each cow enters one of the milking stalls milking cups are attached to its teats (Figure 1), and the milk is sucked out. The milk is piped to a holding tank where it is mixed with the milk from all the other cows in the herd.

Once a day, a milk tanker arrives at the farm to collect the milk and deliver it to the processing factory. As the milk is pumped into the tanker its volume and temperature are measured and a sample is taken.

At the factory the sample is analysed to determine the quality of the milk. This includes measuring such things as how much butterfat, protein and water the sample contains, its mineral content and acidity, and the number of bacteria in it. Not all of these tests are carried out every day. In fact some tests may be done only once a month.

When the tanker arrives at the farm the next day, Robert Holstein is given the most recently available test results on a small computer printout such as that shown in Figure 2. At the end of the day he enters this data into a desktop computer system that was sold to him by the farm's previous owner. The desktop computer includes a database package with records going back to 1990.

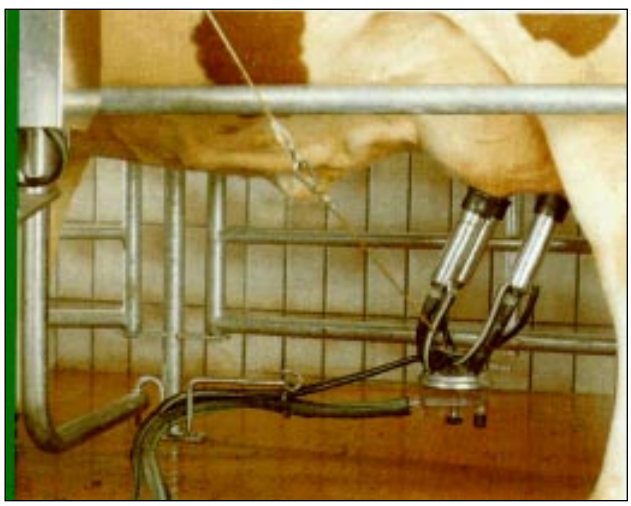

Figure 1

BOVINE DAIRIES INC

SUPPLIER RECEIPT

Supplier No 449
Litres 2635
Temp (°C) 4.6
Date/Time ..... 03/03/98@13:21
Driver No 9
Truck No 52

PREVIOUS RESULTS

Date	Litres	BF%	Pro%
02/03	2730	4.90	3.46
01/03	2604	5.10	3.50
28/02	2594	4.77	3.42

QUALITY RESULTS

Date	Test	Result	Comment
28/02	BMCC	306000	Choicest
21/02	TPC	17000	Premium

BF% – Butterfat percentage
Pro% – Protein percentage
BMCC – Bulk milk cell count (disease test)
TPC – Total plate count (bacteria count)

Figure 2

Keeping data about the milk quality is important because Robert is paid according to the quality of the milk his herd produces. He makes use of the data in two ways.

1. To check that he is being paid the correct amount.

2. To assist in herd management. He does this by using the computer to produce various graphs and tables that show him how such things as total herd production, butterfat content, and overall health of the herd change over time. This information can be used in a number of ways. For example

- by looking at the trends in the bacteria count he can identify problems in the cleanliness of the milking shed and equipment. This allows him to correct the problems before they become serious
- he can experiment with different formulas for feeding programs at different times of the year and see how these formulas affect production.

Question 1

Identify and state the purpose of **five** important computer hardware items and **two** important software items needed to produce the information described in **1.** and **2.** above.

Question 2

The farm's previous owner explained his backup procedure to Robert.

'Once a year I create a new directory [folder] on my hard disk. Then I open that year's data file and save a copy into the new directory [folder].'

State **three** reasons why Robert should be concerned about this procedure.

The problem

It takes Robert Holstein at least three hours to complete the whole milking process. He has to do this twice a day. As a result he has very little time for maintenance of his farm and planning for the future. He thinks that he may need to employ an assistant, but this will be expensive and as yet he does not make much money from the farm.

Furthermore, Robert would like to improve the quality and volume of milk produced by his cows. To do this he needs to make decisions about each cow. Unfortunately he has neither the experience nor the data with which to do this because the existing system provides data that applies only to the whole herd.

The proposed new system

When he was a second-year student at Brookie Agriculture College, Robert carried out an investigation of a new computer-operated herd management system. He still has a copy of the brochure which shows that the system promises to

- reduce the milking time by half
- provide data about the milk produced by each cow
- provide data about the health of each cow.

The brochure describes a complete milking and herd management system called Universal Digital Dairy Evaluation & Reporting System (UDDERS). This system requires individual cows to be identified by means of a collar containing a microchip programmed with each cow's ID number.

The standard UDDERS system consists of a 24-stall rotary milking shed and a microprocessor-based controller. This controller includes a built-in keypad to allow the farmer to input instructions, and a small LCD display screen. The controller is connected to a number of devices distributed throughout the milking shed.

These devices include

- a sensor that reads the ID number from the microchip attached to the cow's collar (this device is situated at the entry to the milking shed)
- a sensor for weighing each cow (this device is also situated at the entry to the milking shed)
- sensors for measuring milk flow rate, volume, butterfat content, indications of any diseases that affect milk or milk production (there is a set of these sensors in each milking stall)
- a set of control devices in each milking stall for automatic diversion of milk, cup removal, and udder cleaning.

The microprocessor-based controller stores all the data obtained from these sensors while the cows are being milked.

Since Robert already has a 32-stall rotary milking shed (Figure 3) he asks the company whether it is possible to install the electronic components of UDDERS onto his existing milking equipment. The sales representative, eager to make a sale, says, 'No worries, mate!'.

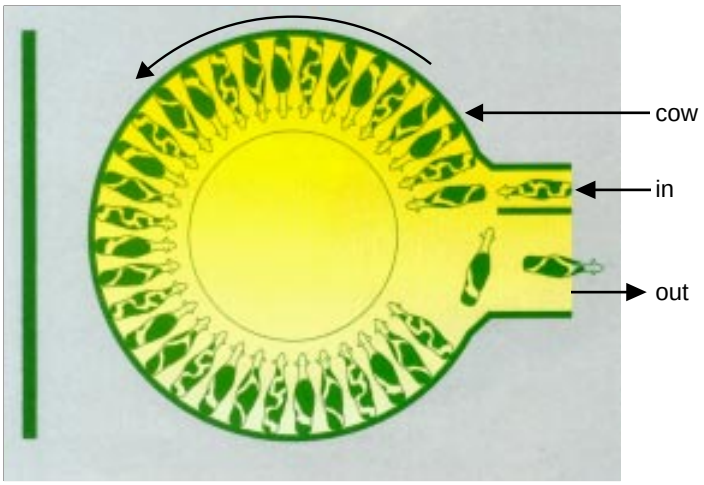

Figure 3 32-stall rotary milking shed

Question 3

Draw and label a diagram showing

- the major hardware components of UDDERS
- the name and direction of each **data flow** between these components.

Where sensors or control devices are installed in each milking stall, you need show only one set of these sensors.

The proposed new system (continued)

Robert would also like to have the data collected by UDDERS transferred to his existing computer so that he can store and analyse it. His existing computer is powerful enough to analyse the data produced by the new system. However, his computer is located at the farmhouse which is about 1 kilometre from the milking shed.

UDDERS provides three data transfer options.

- floppy disk
- 33.6 Kbps modem
- 10 Mbps microwave link

The specifications for these options and for Robert's existing computer system are shown below.

Robert's existing computer

Feature	Specification
Processor	33 MHz 386 DX
Internal memory	2 Mbyte DRAM
Hard disk	100 Mbytes
Floppy disk drive	1.2 Mbyte 5¼ inch
Serial port	25-pin D-connector – 9.6 Kbps (maximum)
Modem	Data transfer rate – 9.6 Kbps (maximum)
Keyboard	102 key standard
Mouse	None
Operating system	DOS

UDDERS data transfer options

Option	Specification
Floppy disk drive	1.44 Mbyte 3½ inch Data transfer rate – 150 Kbps
Modem	Data transfer rate – 33.6 Kbps (maximum)
Microwave link	30 cm parabolic antenna using pulse code modulation Data transfer rate – 10 Mbps (maximum)

Question 4

For the floppy disk, 33.6 Kbps modem and 10 Mbps microwave link, identify and discuss possible hardware compatibility problems by using the information from the tables above.

TURN OVER

The proposed new system (continued)

The data transfer options outlined above for connecting the UDDERS controller to the existing computer can be implemented in several alternative ways.

- Upgrade the floppy disk drive in Robert's existing computer and use 'sneaker net'. In other words, copy the data onto a floppy disk, put on your sneakers and run from the dairy to the farmhouse.
- Install a phone line to the milking shed and use the existing 9.6 Kbps modem connected to Robert's existing computer.
- Install a phone line to the milking shed, upgrade the existing computer's serial port and use a new 33.6 Kbps modem in Robert's existing computer.
- Install a microwave antenna and an interface card into Robert's existing computer.

Question 5

Give **one** advantage and **one** disadvantage for each of the alternatives described above. Which alternative would you recommend and why?

The proposed new system (continued)

The control sensors and switches for the existing milking system are different from the standard sensors and switches required by UDDERS. This means the section of the program that controls the actual milking process will need to be rewritten.

The new system will map the data from the sensors to a set of 32-element arrays of memory locations. Similarly arrays of memory locations will be used to control the output devices. The arrays to be used are listed in the tables on the next page.

The following rules govern the required behaviour of the milking system.

- When the start button is pressed a vacuum will be switched on so as to allow the cups to be attached.
- The system then allows 30 seconds for the cups to be attached.
- After that an alarm should be turned on if the vacuum is detected and one or more of the cups become detached; otherwise the alarm should be off.
- The vacuum switch needs to be turned off when either the flow rate is low or one or more cups are detached.

Arrays for storing input data

Each element in these arrays stores the input from a device in the corresponding stall.

Array name	Meaning of value stored in each array element
VacuumSensor[ ]	1 – vacuum detected 0 – vacuum not detected
StartMilkingSwitches[ ]	1 – start switch on 0 – start switch off
CupSensor[ ]	1 – all cups attached 0 – one or more cups detached
FlowRateOK[ ]	1 – flow rate OK…continue milking 0 – flow rate low…stop milking

Arrays for storing output data

Each element in these arrays controls the output device in the corresponding stall.

Array name	Action caused by storing value in each array element
VacuumSwitch[ ]	1 – turn vacuum on 0 – turn vacuum off
Alarm[ ]	1 – turn stall alarm on 0 – turn stall alarm off

Question 6

Design a new procedure to control the milking process. You can read the sensors by checking values in the arrays. You can turn the vacuum and alarm on or off by writing values to the arrays.

Represent your procedure using an appropriate format.

Question 7

As noted in Question 2, Robert is concerned about his predecessor's backup procedure. The proposed new system will store a great deal more data on Robert's existing computer. As a result, backup will be much more important.

Recommend a new procedure that Robert could use to back up the data on his existing computer and state any new hardware or software required.

Question 8

Robert is concerned about spending a lot of money on this new system only to find that it provides little or no benefit. He therefore insists on a performance clause in the contract with the supplier of UDDERS which guarantees that

- the information obtained from the new system will be reliable
- the minimum time between failures will be greater than 1000 operating hours and the maximum down-time per failure will be one working day
- health problems will be detected earlier than at present.

To justify any claims he might make against this performance clause, what measurements should Robert take and what records should he keep?

Question 9

Answer either Part A or Part B

Part A

Before he purchases his new system, Robert visits the UDDERS home page on the Internet and notices that the company also offers additional software that analyses the data produced by UDDERS. This software is available for a free trial period of one month. Robert thinks that perhaps he can save some money by just downloading the additional software and resetting the date on his computer so that the software trial period never expires.

What advice would you give Robert about setting his system up in this way? Include comments on the possible effects for Robert, the company and the wider community.

OR

Part B

Robert's sister, who also lives on a dairy farm, visits Robert at his new farm not long after the new system is installed. She really likes the concept of the system and can definitely see the benefits. She says she could not afford to purchase the whole system but asks Robert for a copy of the additional analysis software.

Assuming Robert has purchased this additional analysis software, should he give her a copy? Comment from Robert's point of view and the point of view of the company involved. Also comment on the effects of this type of activity on the wider community.

END OF QUESTION BOOK