2.2.1 Data types

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2.2.1 Data types

Computer Science 9608
Topical Past Papers

Zak ZAFAR ALI KHAN

2.2.1 Data Types

Oct/NOV 2003. P1

5. Details of students in a college are stored in a computer system. Among data items stored are

-the student's name

- the student's address

-the student's date of birth

-the mark obtained in the last mathematics examination

-whether or not the student wants to go on a college trip

-how much the student owes towards the cost of the trip.

(a) The name and address are stored as ASCII characters. Explain what is meant by an ASCII character. **[2]**

(b) State data types that are suitable for each of the other pieces of data. **[4]**

May/June 2006. P1

A small business has one shop. It specialises in taking portrait photographs for customers.

Details of customers are stored on paper.

It is decided to buy a stand-alone computer and use it to store customer records in a file.

7. The following fields are to be stored.

- Customer name (to allow customer to be addressed properly when contacted)
- Customer telephone number (so that customer can be contacted when their order has been completed)
- Date of original commission (so that customers are not kept waiting too long)
- Whether or not the order has been paid for.

(a) State a suitable data type for each of the four fields. **[4]**

Oct/NOV 2006

7. The communications system used by the company uses circuit switching for the transmission of data between head office and the copywriters.

(b) When texts are transferred large amounts of data are transmitted.

(i) The characters are sent as ASCII characters.
Explain what is meant by an ASCII character. **[2]**

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2.2.1 Data Types

May/June 2009

2. A stock file in a company has records of all the different items held in stock. The records each hold a number of fields:

- the name of the item in stock
- description of the item
- cost
- whether or not in stock
- number in stock

(a) (i) State a suitable data type for each field. **[2]**

Oct/NOV 2009. P12

3. A library stores details of members on the member file.

(a) Members' names are stored as strings of characters using ASCII.

(ii) Describe how the ASCII character set is represented. **[3]**

Oct/NOV 2010. P11

3. (a) A school information system stores data about each student in the school.

For each of the following data items, state the most suitable data type. Justify your choice.

(i) Home telephone number **[2]**
(ii) Number of subjects studied **[2]**
(iii) Whether or not the student is going on the school trip **[2]**

Oct/NOV 2010. P13

3. (a) A shop's stock control system stores data about the goods in the shop.

For each of the following data items, state the most suitable data type. Justify your choice.

(i) Bar code number **[2]**
(ii) Price in dollars **[2]**
(iii) Whether on order or not **[2]**

ID
Telephone #
String

May/June 2011. P11

3. (a) (i) Explain what is meant by the character set of a computer.

(ii) Explain how a character is represented in a computer. **[4]**

2.2.1 Data Types

(b) Explain the representation of integers in a computer. **[3]**

May/June 2011. P13

3. (a) Explain how a character is represented in a computer. **[2]**

(b) Explain how integers are represented in a computer. **[3]**

(c) Explain how a Boolean value is stored in a computer. **[2]**

May/June 2011. P21/P22

1. Ahmed, a designer, stores the following details of each job that he does in a file.

- job ID (a whole number between 1 and 1000 inclusive)
- job description
- price (greater than $10 and not more than $5000)
- expected completion date
- paid (yes/no)

(a) Complete the following table.

Field Name	Data Type	Size of Field (Bytes)
JobID		
JobDescription		
Price		
ExpectedCompletionDate		
Paid		

[10]

May/June 2011. P23

2. Amber stores the names of her favourite song tracks in an array. She has 56 track names at the moment and expects to reach 150. She defined the array as one-dimensional, size 150 and will store strings. She then initialised each element of the array.

(c) As her collection grows, Amber decides to hold more information about each track. The data for each track is structured as a record.

Each record contains the following data:

- unique track ID (a whole number between 1 and 150)
- track name

2.2.1 Data Types

1 Rec = 32 B
150 Rec = 32×150 = 4800 B

- date bought
- cost
- solo artist (yes/no)

1024 / 512 — 512 B — Housekeeping
512 × 3 = 1.5K

Complete the following table.

Field Name	Data Type	Size of Field (Bytes)
TrackID	INT.	4
TrackName	STRING.	15
DateBought	DATE	8
Cost	REAL.	4
SoloArtist	BOOLEAN	1
	+ 32 Bytes.	

4800 / 1024 = 4.69 KB — Actual File Size

4800 × 1.1 = 5280 B — House-keeping 10%.
= 5.16 KB

[10]

Oct/NOV 2011 P21/P22

1 Ahmed is writing a program to record the data of members of the school football squad.

(f) Ahmed needs to store more information about the players. He creates a record structure that contains PlayerID (a whole number between 1 and 50), Sex (m or f), PlayerName, Position (f, d or g), and DateOfBirth.

Complete the table.

Field Name	Data Type	Size of Field (Bytes)
PlayerID		
Sex		
PlayerName		
Position		
DateOfBirth		

[10]

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May/June 2012. P21/22

1 Anna wants to find out about her fellow students' reading habits. It will be part of her Literature coursework.

She will ask questions online, so starts by designing a screen layout. The first four questions will ask for:

- student's first name
- date of birth
- type of book they prefer (printed, audio-book or e-book)
- whether student reads novels (yes/no)

(c) The responses from each student will be stored as a record consisting of the following fields:

- FirstName
- DateOfBirth
- BookType
- ReadsNovels

Complete the following table. Only a single value should be given for the Field Size.

Field Name	Data Type	Size of Field (Bytes)
FirstName		
DateOfBirth		
BookType		
ReadsNovel		

[8]

Oct/NOV 2012 P21

4 Super Bikes will store the data in files.

(a) One file will store the following data:

- bike ID
- bike type
- date bought
- currently needs repair

Complete the following table. Use a single value for Field Size.

Field Name Data Type Field Size (in bytes)

2.2.1 Data Types

Field Name	Data Type	Size of Field (Bytes)
BikeID		
BikeType		
DateBought		
NeedsRepair		

[4]

Oct/NOV 2012 P22

3 Super Cars will store the data in files.

(a) One file will store the following data:

- car registration
- make of car
- date car bought
- whether on hire or not

Complete the following table. Use a single value for Field Size.

Field Name	Data Type	Size of Field (Bytes)
CarReg		
Make		
DateBought		

OnHire		

[4]

Oct/NOV 2012 P23

4 Super Bikes will store the data in files.

(a) One file will store the following data:

- bike registration
- purchase cost of bike
- insurance rating (A, B or C only)
- whether or not service is due

Complete the following table. Use a single value only for Field Size.

2.2.1 Data Types

Field Name	Data Type	Size of Field (Bytes)
BikeReg	STRING	10
PurchaseCost	REAL	4
InsuranceRating	CHAR	1
ServiceDue	BOOLEAN.	1

16B

16 x 100 = 1600 B
160 10%.
1760 House keeping
B

1760 / 1024
= 1.72
KB

[4]

May/June 2013. P21/22

1 Meena wants to develop a program to keep a record of her coursework assignments.

She will want to enter, sort and print out data.

She decides to modularise the solution.

AssignmentNo
AssignmentID
} INTEGER.

(b) (i) Each record needs another field to uniquely identify that record.

State an appropriate identifier for this field and state a suitable data type for it. [2]

(iii) State the number of bytes needed to store a value in the field IsMarked. [1]

Boolean. 1B.

May/June 2013. P23

1 Meena wants to develop a program to keep a record of her examination results.

She will want to enter, sort and print out data which is stored as a file of records.

Each record will contain at least the following data:

- subject
- examination title
- level
- date sat
- mark

32

An example of an examination title is 'General Certificate of Education'.

The DateSat field will contain only the month and year that the examination was taken.

For all subjects the mark is between 0 and 100 inclusive.

The level is 'O' or 'A'.

(a) Complete the table. Use a single value for the size.

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2.2.1 Data Types

Field Name	Identifier	Data Type	Size (In Bytes)
subject	Subject	STRING	
examination title	ExamTitle	STRING	34
level	Level	CHAR	1
date sat	DateSat	STRING	4
mark	Mark	INT.	4

DataBase File / Memory. 43

[6]

(c) (i) Each record needs another field to uniquely identify that record.

State an appropriate identifier for this field and state a suitable data type for it. [2]

ResultID INT.

Oct/Nov 2013. P22

2 James plans to store the titles and authors of his favourite ebooks in an array. He has 56 ebooks at the moment and expects to reach 150.

A two-dimensional array `MyEbooks` is to be used.

(d) James' friend, Jatinder, uses his idea, but decides to store more information about each of her ebooks.

Complete the following table. Use a single numerical value for Field size.

Identifier	Description	Data type	Field size (Bytes)
EbookID	a unique ebook ID, a whole number between 1 and 500		
BookTitle	the title of the ebook	STRING	
Author	the author of the ebook		
DateBought	date bought		
Cost	price paid		
Fiction	fiction or non-fiction		

[8]

2.2.1 Data Types

May/June 2014. P23

1 (a) Sheena has inherited a recipe book from her grandmother. All the recipes give ingredient measurements in ounces. Sheena wants to write a program to produce a conversion table that helps her use the correct weight in grams.

To convert ounces into grams: 1 ounce is 28.35 grams.

The conversion table will show the number of grams to the nearest whole number:

Conversion Table

Ounces	Grams
1	28
2	57
:	:
16	454

(i) Sheena writes pseudocode that uses the variables in the table below. Complete the identifier table.

Identifier	Data type	Description
Ounces		Variable used as control variable in FOR loop
Grams		Variable used for storing result of conversion calculation

[2]

2 Sheena wants to set up a business selling home-made cakes. She wants customers to order online.

She needs to know:

- customer's name
- customer's contact telephone number
- the date the cake is to be ready
- the type of cake o fruit cake
  - victoria sponge
  - gateau
  - cheesecake
- whether the cake is to be delivered or not.

2.2.1 Data Types

(b) Sheena wants to store the data for each order as a record consisting of the following fields:

- `CustomerName`
- `TelephoneNumber`
- `DateReady`
- `CakeType (F, V, G or C)`
- `Price ($)`
- `ToBeDelivered`

(i) Complete the following table of fields for the `CakeOrder`. Give one value for each field size.

Field name	Data type	Field size (bytes)
CustomerName		
TelephoneNumber		
DateReady		
CakeType		
Price		
ToBeDelivered		

[8]

2.2.1 Data Types

Oct/Nov 2014.P22

1 A sports club in a town organises an annual sports day for competitors aged 8 to 18. The organiser wants these competitors to enter the sports day events online.

To enter an event, each competitor needs to supply the following information:

- Competitor name
- Age in years
- Whether or not they are a sports club member
- The letter code for the single event they want to enter:
  - A 50 m race
  - B 100 m race
  - C Long jump
  - D High jump
  - E 5 km cycle race
  - F 25 m swimming

(b) The entries will be stored as records consisting of the following fields.

(i) Complete the following table. Give a single value for each Field size.

Field name	Data type	Field size (bytes)
CompetitorName		
CompetitorAge		
ClubMember		
EventEntered		
EntryFee		

[10]

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2.2.1 Data Types

May/June 2015.P22

3 A board game is designed for two players, O and X.

At the beginning, all cells of a 3 x 3 grid are empty.

The players take turns in placing their marker in an empty cell of the grid; player O always starts.

The game ends when one player completes a row, column or diagonal or the grid is full.

Here is one example after three turns:

		O
	O	X

Ali wants to write a program to play the game.

(c) (v)

	Variable		

Identifier	Variable or Procedure or Function or Array	Data type	Description
GameEnd	Variable	BOOLEAN	FALSE if game in progress TRUE if there is a winner or the grid is full
Grid	ARRAY		To store the current state of the game
CurrentPlayer			The marker value ('O' or 'X') of the current player
PlayerTakesTurn			Current player chooses cell Program checks if it is valid and stores marker
DisplayGrid			Outputs the contents of the grid
HasPlayerWon			Checks if the current player has completed a row, column or diagonal
GridFull			Checks if the grid is full
SwapPlayer	PROCEDURE		Swaps the value of CurrentPlayer

[5]

2.2.1 Data Types

Oct/Nov 2015.P21/P23

1 (a) A college provides courses for the local community. The Computing teacher, Ravi, wants to develop a program to keep details of the courses. One way of storing this data will be to use records. Each record will contain the fields shown in the table below.
Complete the table.

Field	Identifier	Data type	Example of input data	Field size (in bytes)
course code	CourseCode		015110217	
title	Title		Programming for Beginners	
tutor (3-letter initials)	Tutor		PGL	
day of week (1 – Monday … 7 – Sunday)	Day		2	
lab based?	IsLabBased		TRUE	
session duration in hours	SessionHours		2.5	
fee ($)	CourseFee		25.50	
date course starts	StartDate		02/11/2015	
date course ends	EndDate		03/12/2015	

[5]

(b) Use a high-level programming language to define a course record with identifier CourseRecordType and the fields listed in part (a).

Oct/Nov 2015.P22

1 (a) Sheena wants to develop a program to keep details of the books she has read.
One way of storing this data will be to use records. Each record will contain the fields shown in the table below.
Complete the table.

2.2.1 Data Types

Field	Identifier	Data type	Example of input data	Field size (in bytes)
Title	`Title`		How to solve it	
Author	`Author`		G Polya	
International Standard Book Number	`ISBN`		9780691119663	
Number of pages	`NumberOfPages`		253	
Price ($)	`BookPrice`		12.50	
Date started to read book	`DateStarted`		28032012	
Date finished reading book	`DateFinished`		17052012	
Paperback?	`IsPaperback`		TRUE	
Rating (range 0 to 5)	`Rating`		4	

[5]

(b) Use a high-level programming language to define a book record with identifier `BookRecordType` and the fields listed in part (a). **[4]**

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2.2.1 Data Types

Computer Science (9608)

May/June 2015.P21/P22

1 A marathon runner records their time for a race in hours, minutes and seconds.

An algorithm is shown below in structured English.

INPUT race time as hours, minutes and seconds

CALCULATE race time in seconds

STORE race time in seconds

OUTPUT race time in seconds

(a) The identifier table needs to show the variables required to write a program for this algorithm. Complete the table.

Identifier	Data type	Description
RaceHours	INTEGER	The hours part of the race time.

[3]

(b) Before the program is written, the design is amended.
The new design includes input of the runner's current personal best marathon time (in seconds).
The output will now also show one of the following messages:

- "Personal best time is unchanged"
- "New personal best time"
- "Equals personal best time"

(i) Show the additional variable needed for the new design.

Identifier	Data type	Description

[1]

2.2.1 Data Types

5 A company creates two new websites, Site X and Site Y, for selling bicycles.

Various programs are to be written to process the sales data.

These programs will use data about daily sales made from Site X (using variable SalesX) and Site Y (using variable SalesY).

Data for the first 28 days is shown below.

	SalesDate	SalesX	SalesY
1	03/06/2015	0	1
2	04/06/2015	1	2
3	05/06/2015	3	8
4	06/06/2015	0	0
5	07/06/2015	4	6
6	08/06/2015	4	4
7	09/06/2015	5	9
8	10/06/2015	11	9
9	11/06/2015	4	1
...			
28	01/07/2015	14	8

(e) The DISCOUNT_DATES text file is successfully created.

The company now wants a program to:

- key in a date entered by the user
- search the text file for this date
- if found, output one of the following messages:
  - "No discount on this date"
  - "This is a discount date"
- if not found, output "Date not found"

(i) Add to the identifier table to show the variables you need for this new program.

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2.2.1 Data Types

Identifier	Data type	Description
DISCOUNT_DATES	FILE	Text file to be used
SalesDate	DATE	Date on which the sales were made.
SalesX	INT	Items sold from site X.
SalesY	INT	Items sold from site Y.

[3]

May/June 2015.P23

1 Horses are entered for a horse race. A horse may have to carry a penalty weight in addition to the rider. This weight is added to the saddle. The penalty weight (if any) depends on the number of wins the horse has achieved in previous races.

The penalty weight is calculated as follows:

Number of previous wins	Penalty weight (kg)
0	0
1 or 2	4
Over 2	8

A program is to be written from the following structured English design.

1 INPUT name of horse
2 INPUT number of previous wins
3 CALCULATE penalty weight
4 STORE penalty weight
5 OUTPUT name of horse, penalty weight

HorseName Str
PrevWins Int
PenaltyWeight Real.

(a) Complete the identifier table showing the variables needed to code the program.

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2.2.1 Data Types

Identifier	Data type	Description
HorseName	STRING	Name of horse participating.
PreviousWins	INTEGER	Num. of wins in previous games.
PenaltyWeight	REAL/INT	Penalty weight applied as per previous wins.

May/June 2016. P23

2 The engine management system of a car includes an energy-saving facility. When certain conditions are met, this facility will automatically stop the engine.
The system is to be software-based. It will include a subroutine, `EnergySaver`, which repeatedly takes data from

sensors in the car. The subroutine decides whether or not to set the `EngineStop` value.
The table of identifiers used by this subroutine is shown below.

(a) Complete the identifier table below by stating the data types.

Identifier	Data type	Description
`Accelerator`	INT.	Accelerator pedal position Values: 0 to 100 in steps of 1 Meaning: 0: none (not pressed) 100: maximum (fully pressed)
`EngineTemp`	REAL.	Engine temperature in °C (-50 to +150 stored to 1 decimal place)
`NormalTemp`	INT.	Normal engine temperature in °C Whole number; typical value 90
`Speed`	INT.	Road speed of car (in km/hr) Values: 0 to 200 in steps of 1
`EngineStop`	BOOLEAN.	Value used to signal engine must be stopped Possible values: TRUE: stop engine FALSE: run engine

[5]

2.2.1 Data Types

May/June 2018. P21

1 b (ii) Programming languages support different data types.

Give an appropriate data type for each of these variables from **part (b)(i)**.

Variable	Data type
`MyGreeting`	String
`MyInitial`	String
`AgeInYears`	INT.
`Weight`	REAL.
`Married`	BOOLEAN.

[5]