

Topic: 2.1 Algorithm design and problem-solving

May/June 2006

12 A music club keeps its members' details on a computer file.

(a) Complete the table below which shows the data type, field length and validation check used for the club members' data.

	Data type	Field length	Validation check
Name			
Address			
Date of birth			
E-mail address			

Oct/Nov 2006

1 Explain, using examples where appropriate, the following computer terms:

(a) verification

[2]

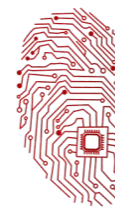
Oct/Nov 2006

11 A school keeps a spreadsheet of examination results in four subjects. Part of the spreadsheet is shown below.

	A	B	C	D	E	F	G	H
1	Name	Class	Maths	Science	IT	English	Average Mark	Pass/Fail
2	Allen	11A	33	24	19	44	30	
3	Dyos	11B	41	54	70	31	49	
4	Kegg	11A	82	69	57	52	65	
5	Khan	11C	44	21	50	85	50	
6	Kolacz	11A	73	51	73	51	62	
7	Lenski	11B	17	41	40	34	33	
8	Peruza	11C	87	72	64	61	71	

(e) State the validation check that should be carried out on data entered in cells C2 to F8 to ensure values over 100 are not input.





Topic: 2.1 Algorithm design and problem-solving

May/June 2007

11 (b) Input data needs to go through a validation process.

- (i) Explain the term validation.
- (ii) Describe one type of validation check.

Oct/Nov 2007

15 A school Science department is going to use a database to record details about its equipment.

(b) Part of the database is shown below:

Equipment	Code No	Quantity in Stock	Need to re-order?	Supplier Name	Price (\$)	Stock Value (\$)
Beaker	01043	25	Y	Labquip	1.04	26.00
Test tube	01051	200	N	Labquip	0.40	80.00
Clamp stand	01065	51	N	Anglera	3.25	165.75
Tongs	01151	23	Y	Anglera	0.55	12.65
Spatula	01222	62	N	Anglera	0.66	40.92
Flask	01341	15	Y	Labquip	1.70	27.50

- (i) As data is entered it needs to be verified. Describe one way this could be done. [1]
- (ii) Data also needs to be validated. Using fields from the database as examples, Describe two different validation checks which could be performed on the data.

May/June 2008

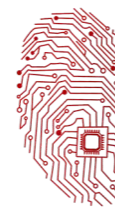
5 Computer systems can be affected by viruses.

(d) Examination results are stored in students' records as marks out of 100. Give two different validation checks that could be performed on students' marks.

6

(d) Examination results are stored in students' records as marks out of 100. Give two different validation checks that could be performed on students' marks. [2]





Topic: 2.1 Algorithm design and problem-solving

Oct/Nov 2008

15 A database has been produced showing solar system statistics.

Name of planet	Distance from sun ($\times 10^6$) (km)	Number of moons	Number of rings	Maximum surface temperature ($^{\circ}\text{C}$)	Diameter (km)
Mercury	58	0	0	427	4880
Venus	108	0	0	480	12100
Earth	150	1	0	58	12756
Mars	228	2	0	17	6787
Jupiter	778	16	3	-150	143200
Saturn	1427	18	1000	-180	120000
Uranus	2871	15	11	-210	51800
Neptune	4497	8	4	-214	49528
Pluto	5914	1	0	-220	2330

(d) Name a different validation check for each of the following fields.

- (i) Maximum surface temperature ($^{\circ}\text{C}$)
- (ii) Name of planet

Oct/Nov 2009

1 Explain, using examples where appropriate, the meaning of these computer terms.

(e) validation





Topic: 2.1 Algorithm design and problem-solving

May/June 2010 P11

15 A database has been set up to bring together information about the world's tallest buildings. A section of the database is shown below.

Ref No.	Building Name	City	Country	Year	No. of Floors	Height (m)	Height (ft)
TA1	Taipei 101	Taipei	Taiwan	2004	101	508	1667
MA1	Petronas Towers	Kuala Lumpur	Malaysia	1998	88	452	1483
US1	Sears Tower	Chicago	USA	1974	110	442	1451
CH1	Jiu Mao Building	Shanghai	China	1999	88	421	1381
CH2	Finance Centre	Hong Kong	China	2003	88	415	1362
CH3	CITIC Plaza	Guangzhan	China	1996	80	391	1283
CH4	Shun Hing Square	Shenzhen	China	1996	69	384	1260
US2	Empire State Building	New York	USA	1931	102	381	1250
CH5	Central Plaza	Hong Kong	China	1992	78	374	1227
CH6	Bank of China	Hong Kong	China	1989	70	367	1205
DU1	Emirates Tower	Dubai	Dubai	1999	54	355	1165
TA2	Tuntex Sky Tower	Kaohsiung	Taiwan	1997	85	348	1140

(d) For each of the following fields give a different validation check.

Year

Ref No.

Oct/Nov 2010 P11

- 2 (a) State three reasons why a computer system failure might occur (malfunction). [3]
(b) One effect of a computer system failure is the loss or corruption of files. State one way of recovering a file if it has been lost or corrupted. [1]
(c) How is it possible to ensure illegally accessed files are unreadable? [1]

15 A college secretary inputs data into fields on a computer screen as shown below:

<u>Examination Results</u>	
Student Sex:	Subject:
Today's Date:	Grade:
Examination Result (%):	

(a) Choose a suitable different validation check for each of the following:

- (i) Student Sex which can be M or F only
(ii) Today's Date which must be written as, for example, 15/10/2010
(iii) the Examination Result which can be any number from 0 to 100

(b) Apart from validation, how would it be possible to ensure only certain data could be input into each of the fields on the computer screen? [1]





Topic: 2.1 Algorithm design and problem-solving

Oct/Nov 2010 P13

1. Explain, with examples where appropriate, the following five computer terms.

(d) Verification

16 A customer logs on to a secure website using a code and a password. The first stage is to key in a code which is his date of birth (DDMMYY) followed by 1234. The second stage is to type in the first, third, fourth and seventh character of his password.

The customer last logged on to the website on 15th March 2010.

(a) (i) The customer's date of birth is 15th November 1985. What is the customer's code?

--	--	--	--	--	--	--	--	--	--

(ii) Why is this code not unique?

(iii) Suggest how this coding system could be improved.

[3]

(b) (i) The customer's password is PAULO168.

What does the customer need to type at the second stage?

1st	3rd	4th	7th
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

(ii) Why are passwords used?

[2]

(c) If the customer gets through the two stages above he is then directed to a new security page which states:

"You were last logged on to this website on 14th April 2010. Is this correct?"

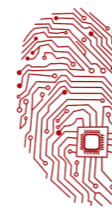
What could have happened to make the customer concerned about this statement? [1]

May/June 2011 P11

7 A spreadsheet has been set up to compare the costs of types of fruit juice sold by a shop.

	A	B	C	D
1	NAME OF FRUIT JUICE	NORMAL PRICE PER BOTTLE (\$)	VOLUME OF BOTTLE (LITRES)	COST PER LITRE (\$)
2	Apple	3.50	1.0	3.50
3	Orange	2.80	1.0	2.80
4	Pomegranate	4.55	0.7	6.50
5	Caju	2.00	2.0	1.00
6	Mango	1.05	0.7	1.50
7			Average cost:	3.06





Topic: 2.1 Algorithm design and problem-solving

(b) What validation check could be carried out on the data in cells B2 to B6? [1]

May/June 2011 P12

8 A media sales company has set up a website.

The opening page is:

DVD media sales company

Please input your Customer ID

Select your film category

(b) (i) Name a validation check that could be used on the Customer ID field? [1]
(ii) Describe TWO types of test data, together with examples, that could be used to see whether the validation check named in (i) works.

16 A book shop uses barcodes for its computerized stock control. Each book title has a barcode which identifies it.



The data is stored in a table.

(a) A sample of the data stored in the table is shown below:

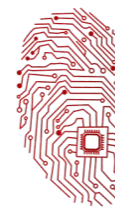
BARCODE	BOOK TITLE	AUTHOR	COPIES	PUBLICATION DATE
123456789012	Blue Lagoon	AA Smith	27	10/2001
345678901234	Happy Hour	BJ Cocktail	30	11/1997
567890123456	Young Blood	CM Vein	19	06/2009

(i) Which is the key field? [3]
(ii) Give TWO examples of when the data in the table will need to be changed.

(b) Each barcode has a check digit.

(i) Explain how the check digit is used as a validation check. [2]
(ii) What type of error can the check digit identify?





Topic: 2.1 Algorithm design and problem-solving

(c) Name DIFFERENT suitable validation checks for EACH of the following fields:
Book title:,Copies:, Publication date:

[3]

Oct/Nov 2011 P13

4 Five definitions and descriptions are shown below on the left hand side.

Five computer terms are shown on the right.

Match the definitions/descriptions on the left to the correct term on the right by drawing connecting arrows.

check if students' ages are in the range 11 to 18

computer generated operation of a chemical process

software that looks for information based on certain key words

system where all the data are collected first before being processed in one go

typing in a password twice to ensure it is correct

verification

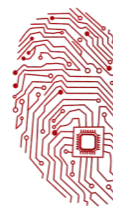
validation

simulation

search engine

batch processing





Topic: 2.1 Algorithm design and problem-solving

May/June 2012 P11

10 Jatinder uses Internet banking.
She uses a 5-digit PIN.

(b) Every time she logs on, she is asked to give 3 random digits from the PIN. She was asked to give her 3rd, 1st and 4th digit. This changes every time she logs on.

Give a reason for this.

[1]

(c) A different application needs the whole PIN to be input.
The following code has been written to check the PIN:

```
c = 0
INPUT PIN
x = PIN
REPEAT
x = x/10
c = c + 1
UNTIL x < 1
IF c < 5
THEN
PRINT "error in PIN entered"
ELSE
PRINT "PIN OK"
ENDIF
```

(i) What value of c and what message would be output if the following PINs were entered?

5 1 0 2 0 Value of c:

Message:

5 1 2 0 Value of c:

Message:

[2]

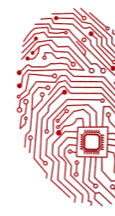
(ii) What type of validation check is being carried out here?

[1]

May/June 2012 P12

9 (b) State two different validation checks and give an example of their use. Each example should be different.





Topic: 2.1 Algorithm design and problem-solving

May/June 2013 P11

15 A spreadsheet was set up to allow customers to work out their monthly payments when borrowing money from a bank. The customer inputs data in column B.

The spreadsheet is as follows:

	A	B	C
1	Interest Calculator		
2	INPUT PRICE OF GOODS	20000	
3	INPUT YOUR DEPOSIT	5000	
4	AMOUNT OF MONEY TO BORROW		15000
5	INPUT % INTEREST RATE	8.0	0.08
6	INPUT NUMBER OF YEARS	4	
7	INTEREST TO PAY		4800
8	YOUR MONTHLY REPAYMENTS		412.50

(e) Give two different validation checks you would use for inputs to cells:

B2

B5

May/June 2013 P12

13 A company requests new customers who register online to give the following details:

- name
- address
- type of credit/debit card
- payment card number

All details must be entered.

(a) (i) Describe one suitable different validation check for each field.

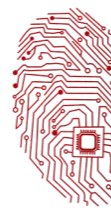
name

address

type of credit/debit card

payment card number





Topic: 2.1 Algorithm design and problem-solving

May/June 2014 P11 (7010)

3 A hospital holds records of its patients in a database. Four of the fields are:

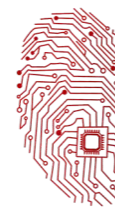
- date of visit (dd/mm/yyyy)
- patient's height (m)
- 8-digit patient ID
- contact telephone number

The presence check is one possible type of validation check on the data. For each field, give another validation check that can be performed. Give an example of data which would fail your named validation check.

A different validation check needs to be given for each field.

Field Name	Name of validation check	Example of data which would fail the validation check
Date of visit		
Patient's height		
Patient ID		
Contact telephone number		





Topic: 2.1 Algorithm design and problem-solving

Past Papers Questions: A Levels

May/June 2003

A college stores its student files on paper which is kept in filing cabinets. The decision is taken to computerise these student files.

A systems analyst is employed to supervise the process.

11. The data stored needs to be as accurate as possible. Twice each year examination grades are reentered (A to G) for each subject. Describe how the techniques of

- (i) verification,
- (ii) validation

are used to ensure that the stored data is as accurate as possible.

[6]

Oct/NOV 2004

9. Customers are identified by a 6 digit code. The first three digits are between 000 and 100 for organisations and between 300 and 600 for individuals. It is important that the 6 digit customer code is correctly entered to the system.

Describe how

- (i) verification
- (ii) validation

can help to ensure that as few errors as possible occur.

[6]

May/June 2006

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.

8. Data that is entered into the file needs to be verified and validated.

(a) Explain what is meant by the terms

- (i) verification;
- (ii) validation.

[2]

(b) Describe two methods that can be used for validating the date of the original commission.

[4]

May/June 2007

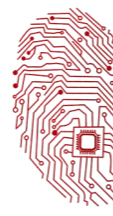
5. (a) Describe what is meant by verification of data.

[2]

(b) Give an example of an application which would require the data input to be verified and explain why it would be necessary.

[2]





Topic: 2.1 Algorithm design and problem-solving

May/June 2009

A company specialises in creating websites for customers.

12. The company stores details of customers and their accounts in a database.

The data input to the database must be verified and validated.

One piece of data which will be input to the database is the amount of money when a customer makes a payment.

- (b) (i) State what is meant by verification of data. [1]
(ii) Describe how the customer payment will be verified when it is input to the database. [2]

The data input to the database must be verified and validated.

One piece of data which will be input to the database is the amount of money when a customer makes a payment.

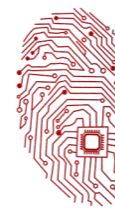
- (c) (i) State what is meant by validation of data. [1]
(ii) Describe how the customer payment will be validated when it is input to the database. [2]

Oct/NOV 2009. P12

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

- (b) When a member's name is input to the system it needs to be validated.
(i) State what is meant by validation. [1]
(ii) Describe two validation checks that can be carried out when a member's name is input to the system. [4]

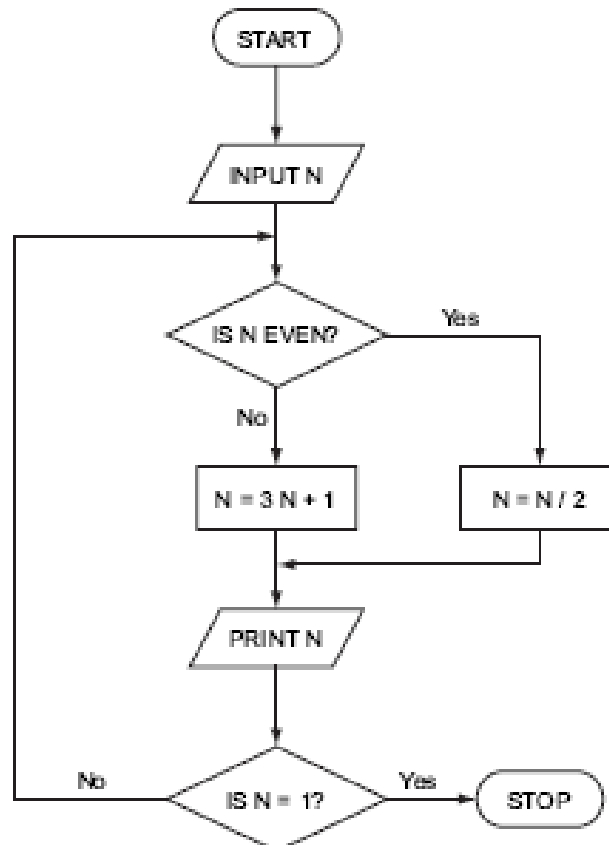




Topic: 2.1 Algorithm design and problem-solving

May/June 2006 (7010)

9



Trace the flow chart using the numbers 2 and 3. Write down each of the values of N in the order that they are printed out.

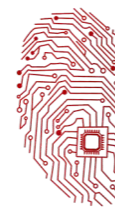
(a) 2

[1]

(b) 3

[2]

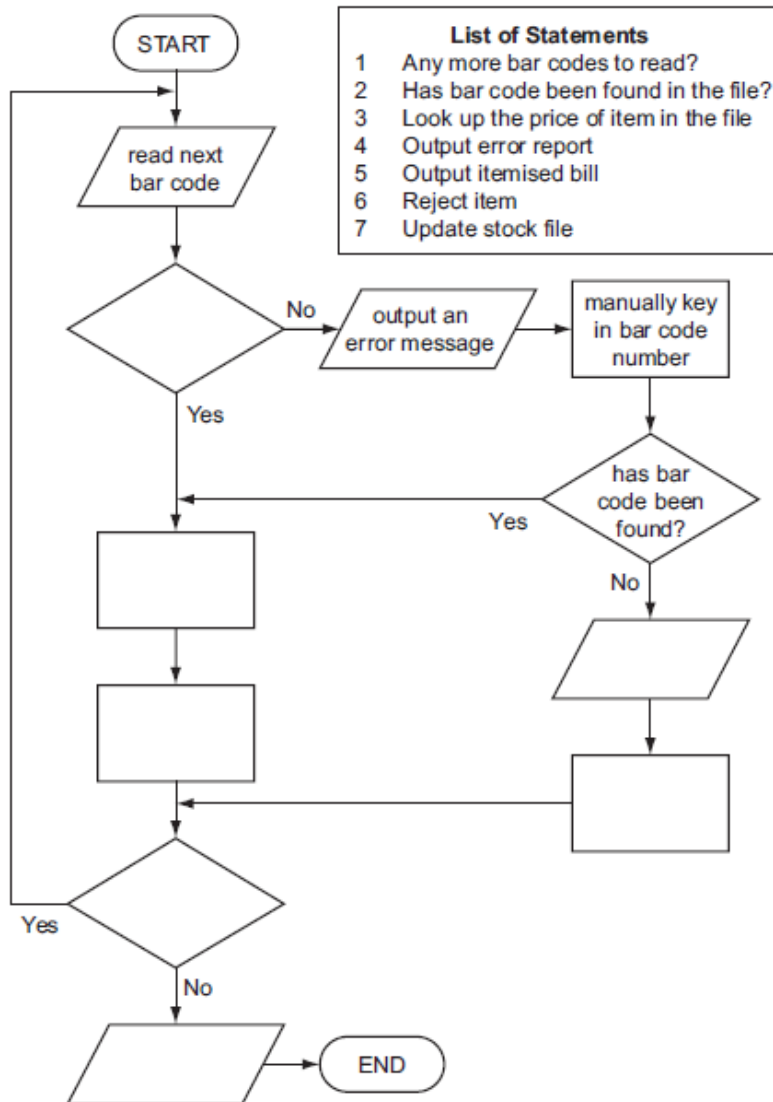




Topic: 2.1 Algorithm design and problem-solving

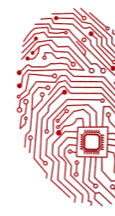
Oct/Nov 2006

17 The following flowchart shows how the bar code written on an item is used to find the price, do stock control and produce an itemised bill. Select statements from the list below to complete the flowchart.



[5]



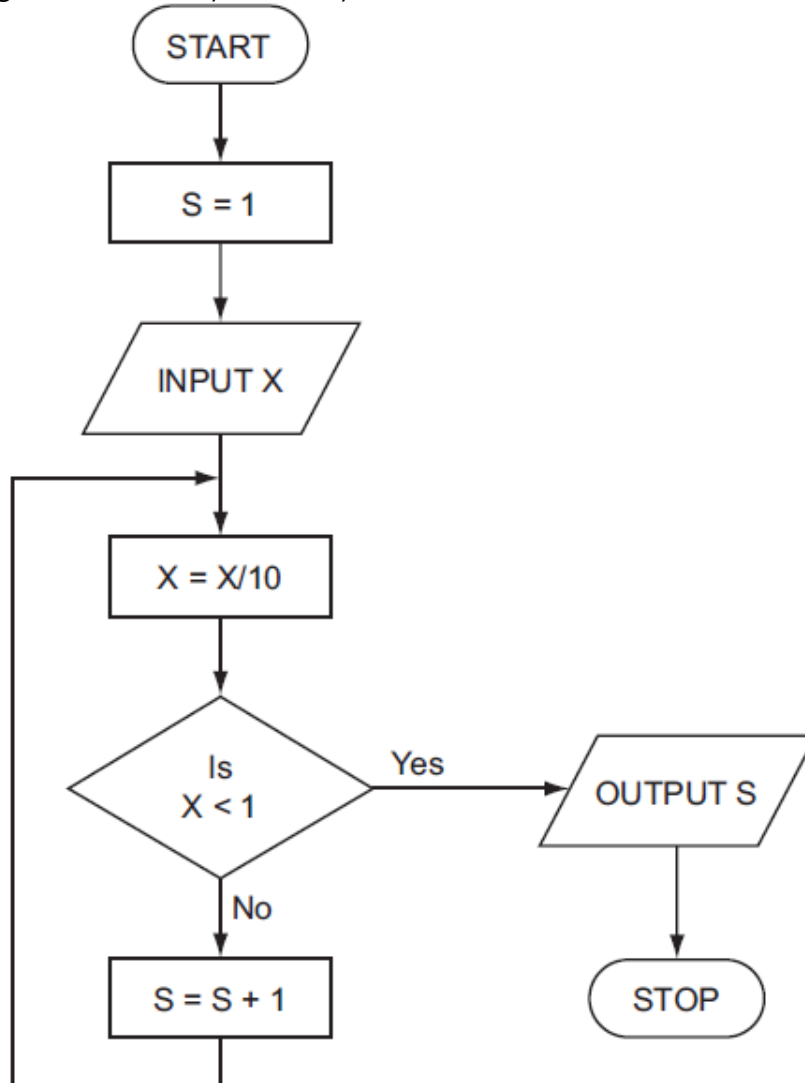


Topic: 2.1 Algorithm design and problem-solving

May/June 2007

2 Describe, with examples, two types of test data which could be used to test a system. [4]

11 Study the following flowchart very carefully.

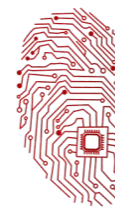


(a) Complete the following table showing the expected output from the flowchart for the three sets of input data:

INPUT X	OUTPUT S
48	
9170	
-800	

[3]

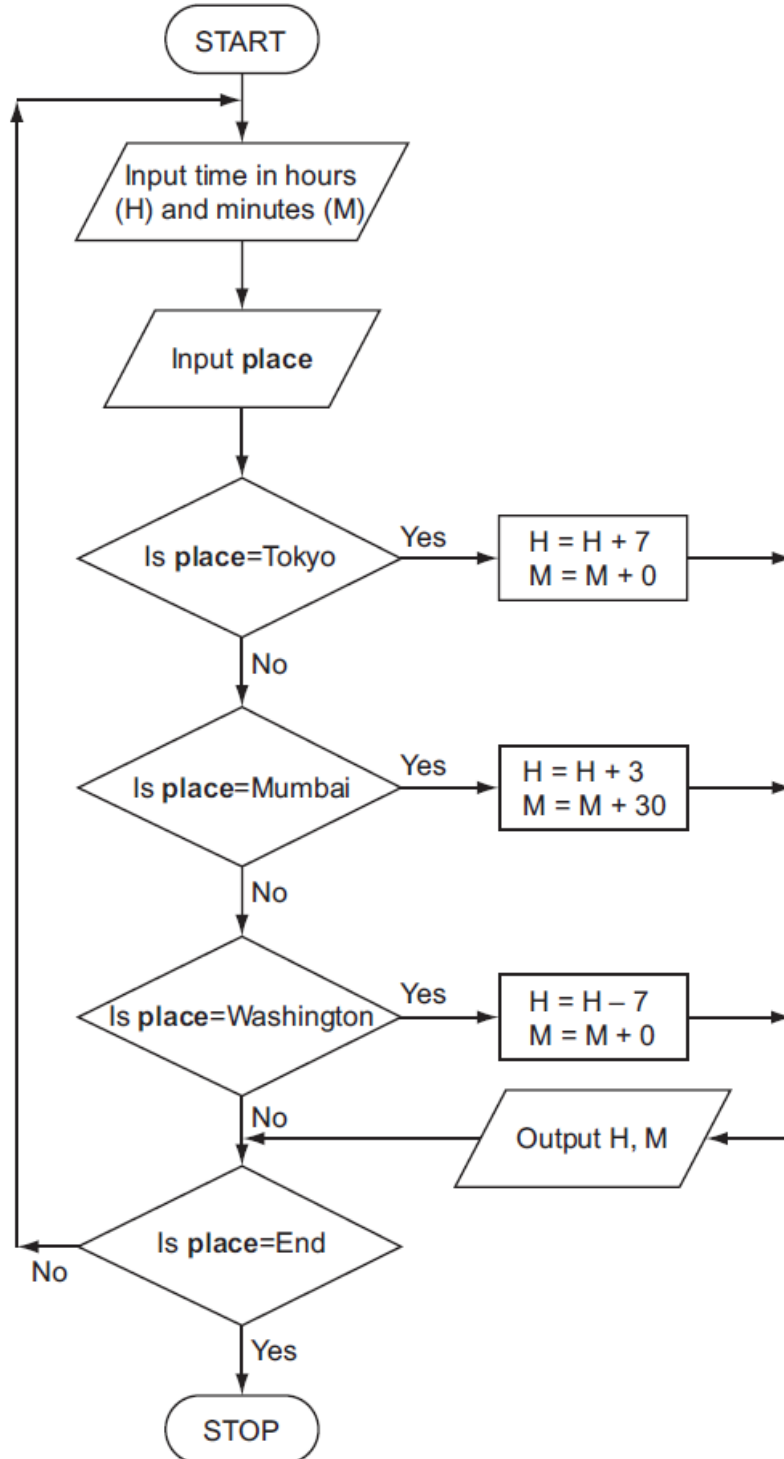


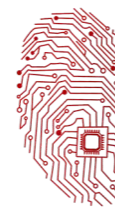


Topic: 2.1 Algorithm design and problem-solving

Oct/Nov 2007

11Majid lives in Cairo but often travels to Tokyo, Mumbai and Washington. A flow chart has been written so he can work out the local time in these three places.





Topic: 2.1 Algorithm design and problem-solving

(a) What output would be produced from the following input?

Input			Output	
place	hours (H)	minutes (M)	H	M
Tokyo	11	15		
Mumbai	15	10		

[2]

(b) What problem would occur if `place = Mumbai` and `H = 15` and `M = 30`?

.....

.....

..... [1]

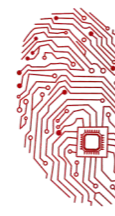
(c) What problem would occur if `place = Washington` and `H = 4` and `M = 0`?

.....

.....

..... [1]

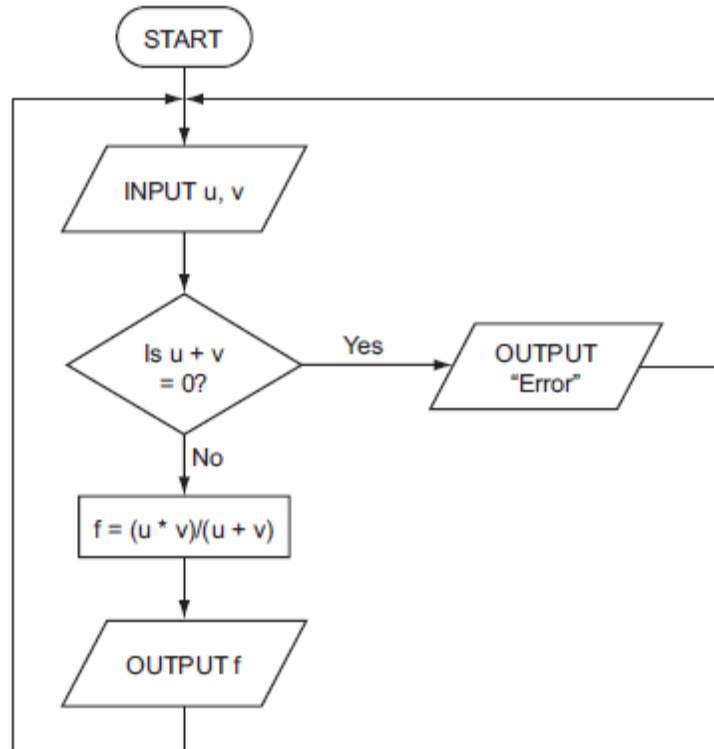




Topic: 2.1 Algorithm design and problem-solving

May/June 2008

9 The following flowchart inputs two numbers, carries out a calculation and then outputs the result.

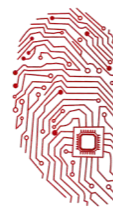


(a) Complete the following table for the three sets of input data.

INPUT		OUTPUT
u	v	
5	5	
6	-6	
12	4	

[3]

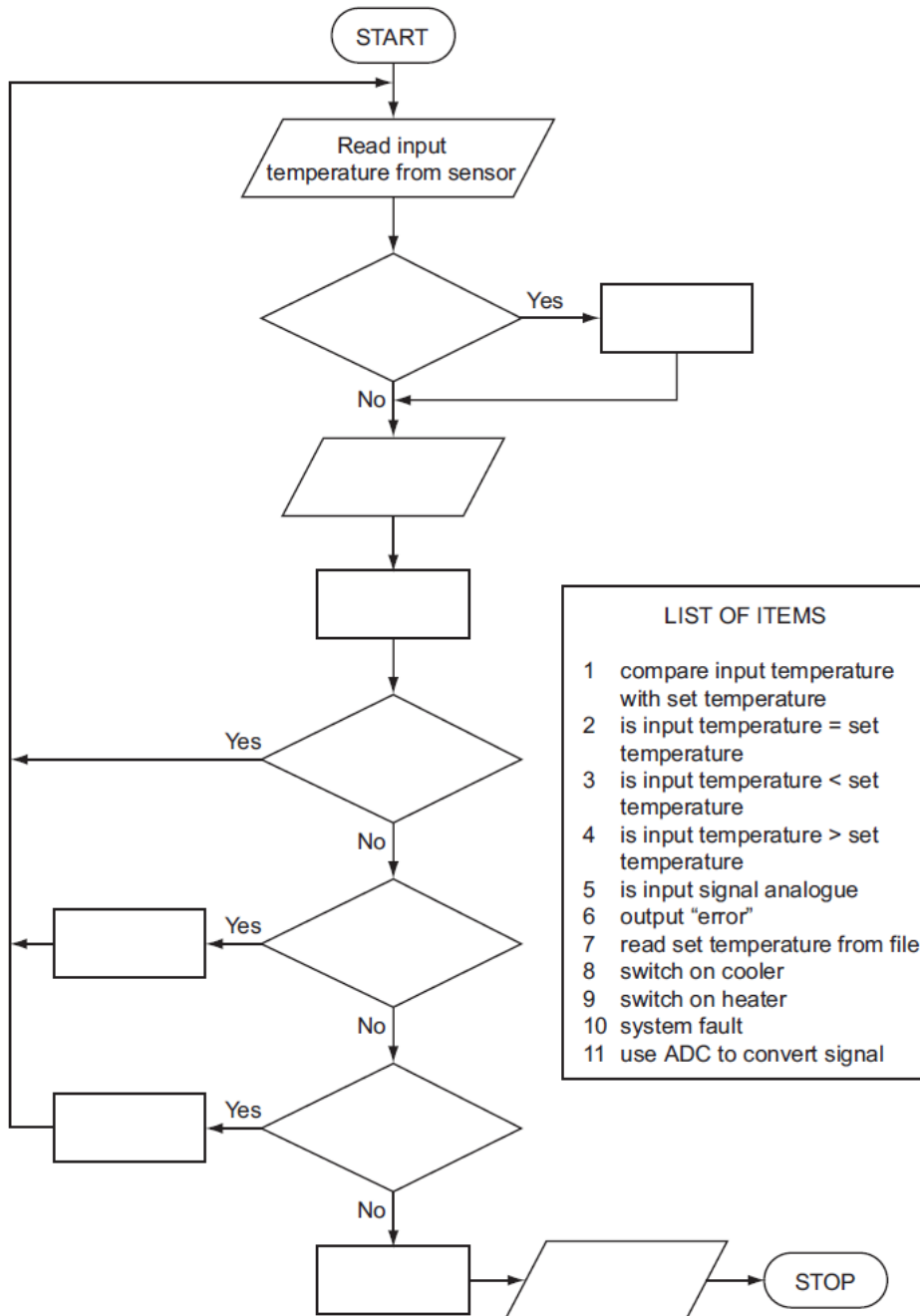




Topic: 2.1 Algorithm design and problem-solving

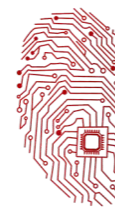
Oct/Nov 2008

17 The following flowchart shows how sensors (which can be analogue or digital) and a computer are used to control the temperature of a greenhouse for plants. Complete the flowchart using the items from the list below.



[6]

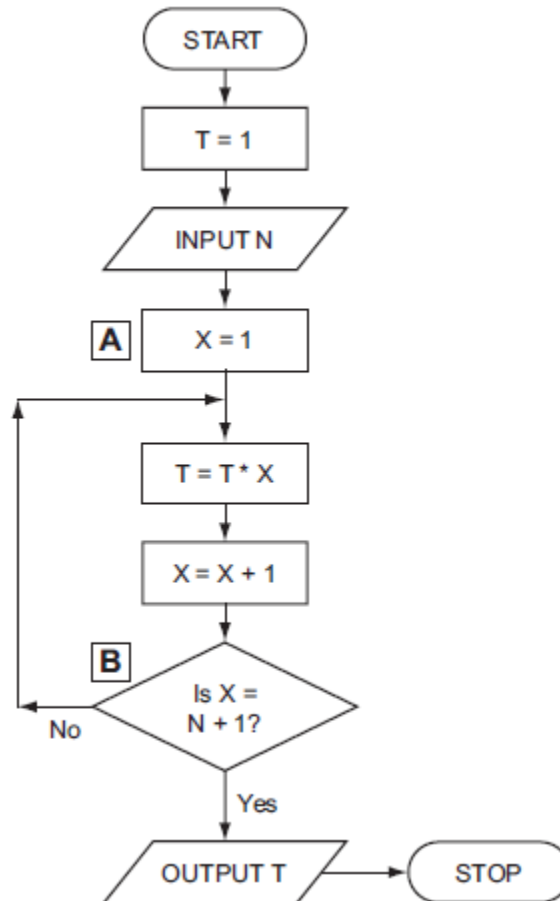




Topic: 2.1 Algorithm design and problem-solving

May/June 2009

14 Study the flowchart very carefully.

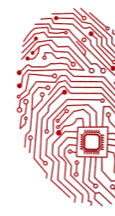


(a) Complete the table to show what outputs you would expect for the two inputs.

Input N	Output T
5	
1	

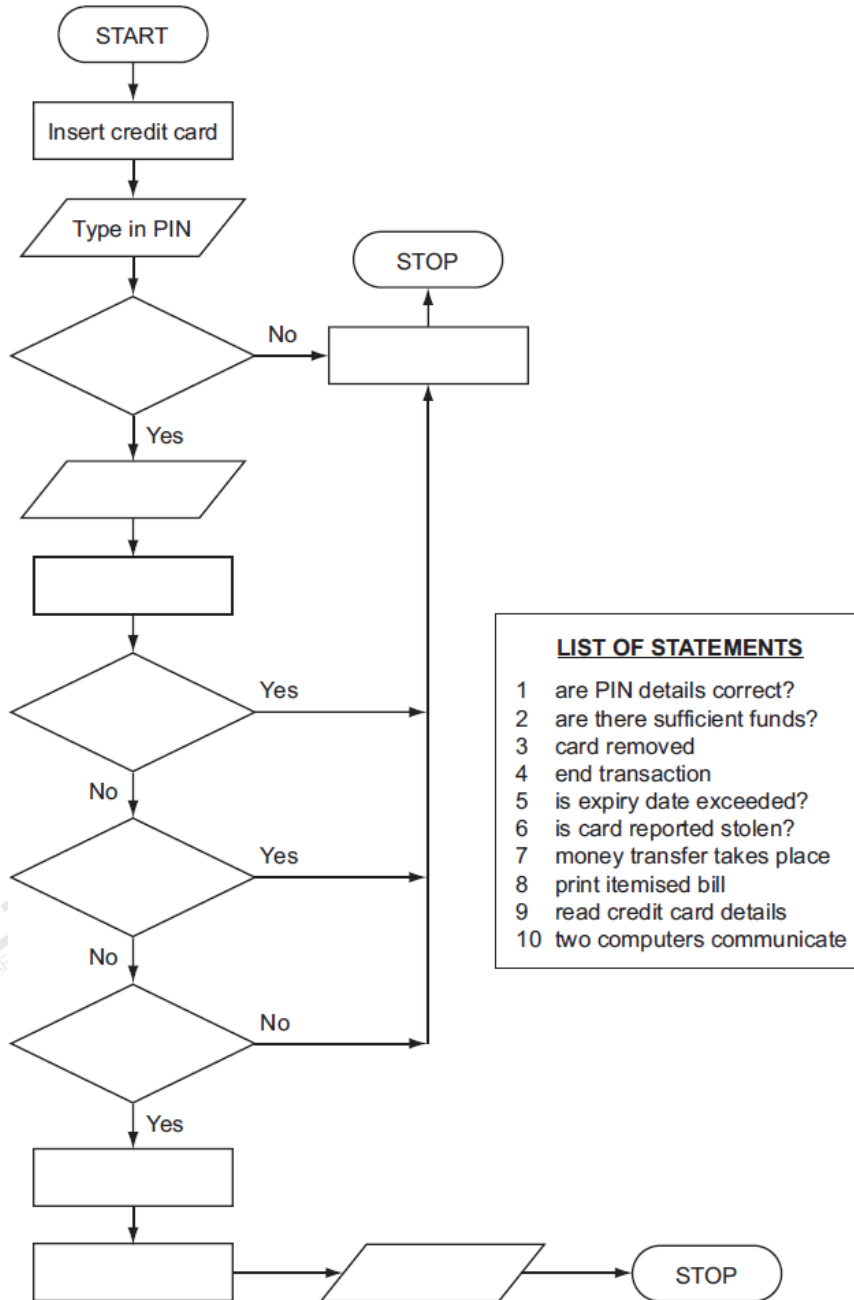
[2]





Topic: 2.1 Algorithm design and problem-solving

16 The following flowchart shows what happens when a customer uses a credit card to pay for goods at a supermarket. Ten of the boxes are blank. Using the items from the list, insert the ten missing statements using the appropriate number only. Each statement may be used once only.



[5]

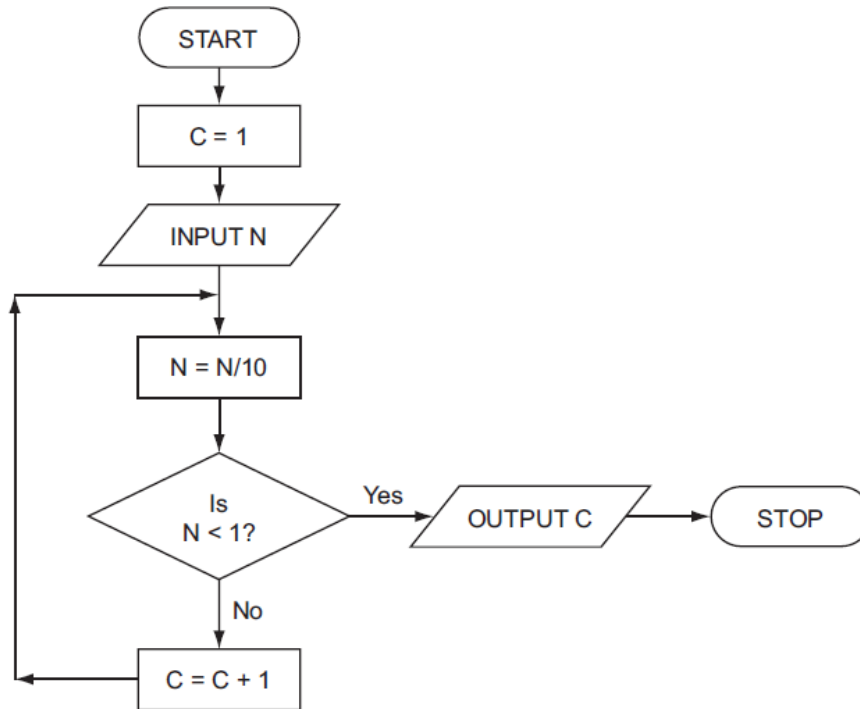




Topic: 2.1 Algorithm design and problem-solving

Oct/Nov 2009. P11

9 Study the flowchart.

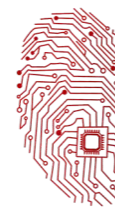


Complete the table to show what outputs you would expect for the three inputs.

INPUT N	OUTPUT C
55	
2100	
1	

[3]

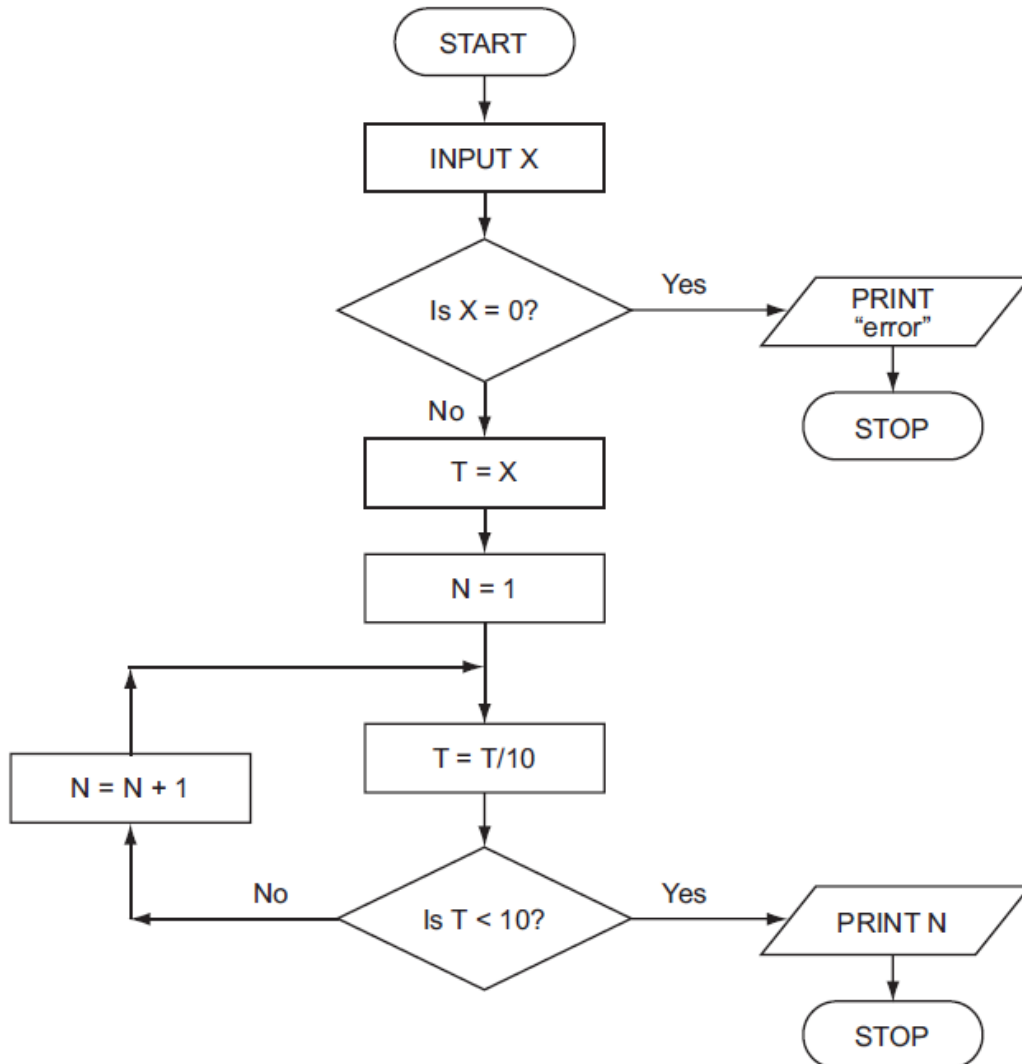




Topic: 2.1 Algorithm design and problem-solving

May/June 2010. P12

13 Study the following flowchart very carefully:

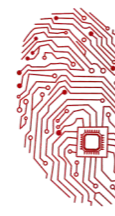


What output would you expect if the following data was input into the flowchart?

X	OUTPUT
-150	
540	
0	

[3]



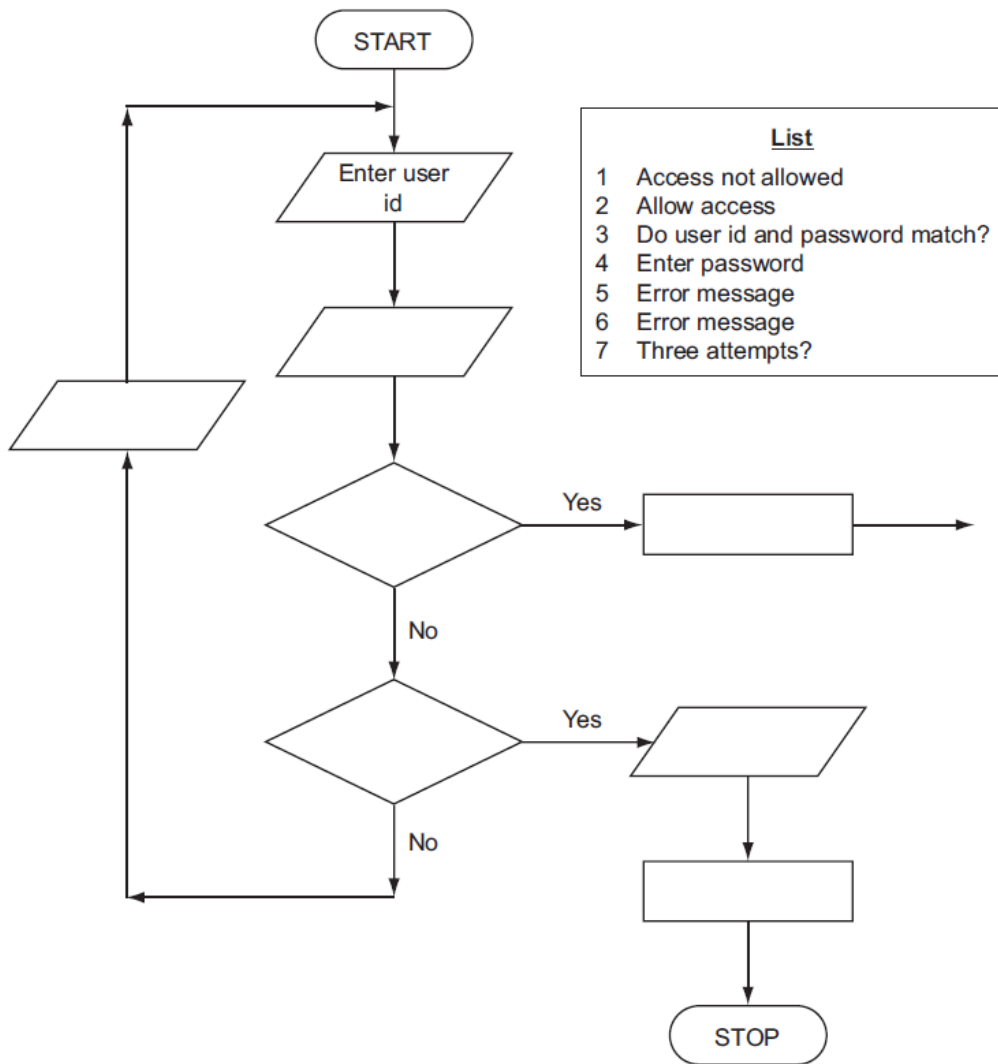


Topic: 2.1 Algorithm design and problem-solving

Oct/Nov 2010. P11

4 (a) To log on to a computer, a user needs to type in a user id followed by a password; these should match up. Only three attempts are allowed.

The flowchart below shows the log on procedure. Several boxes have been left blank. Complete the flowchart using items from the list.



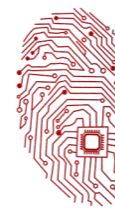
[3]

(b) Sometimes it is necessary to key in the password twice.

Name this type of data check.

..... [1]



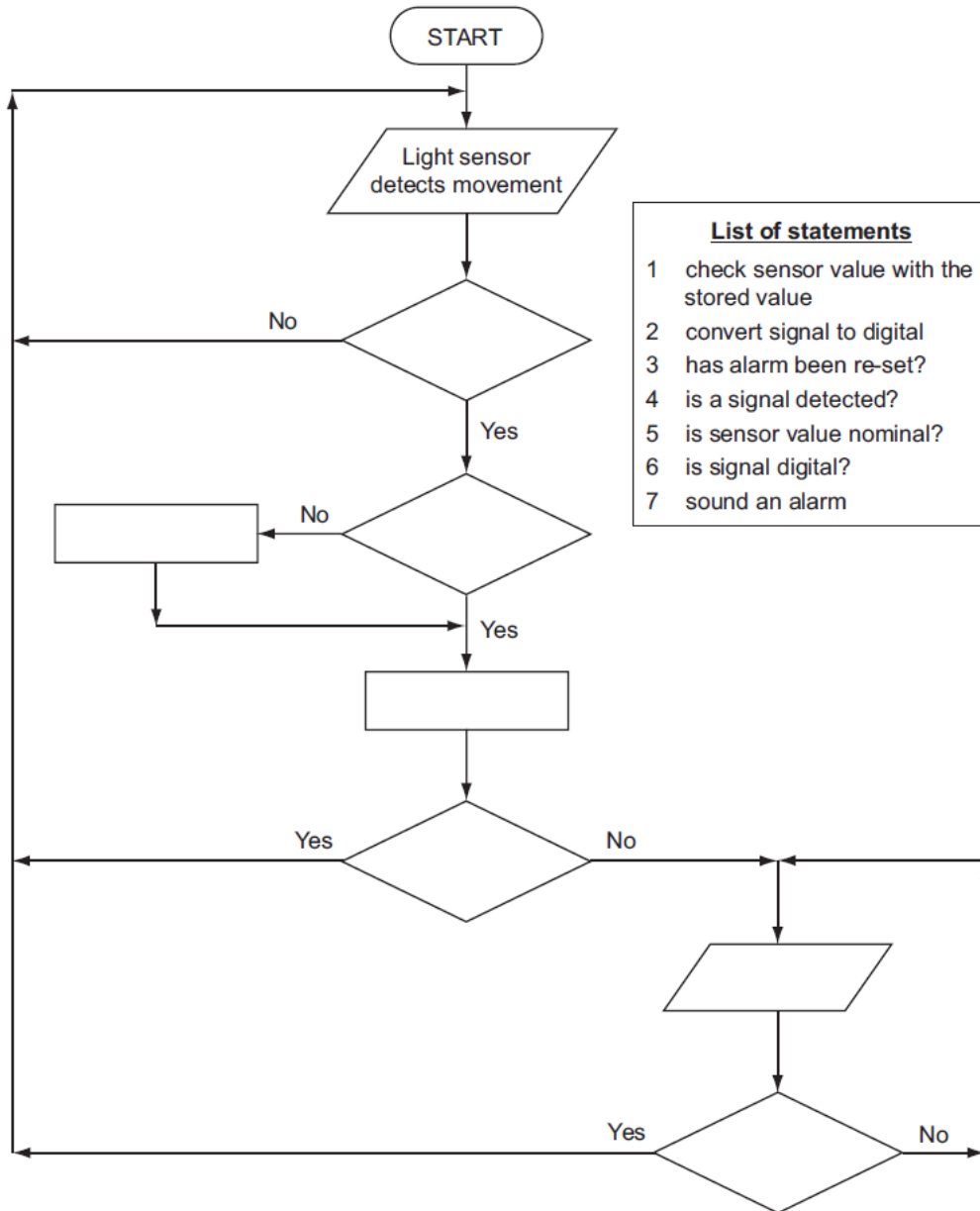


Topic: 2.1 Algorithm design and problem-solving

Oct/Nov 2010. P13

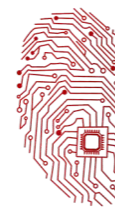
15 (a) The following flowchart shows how a burglar alarm system uses light sensors to determine if an intruder has entered the house and decides to sound an alarm.

Select statements from the list below, using numbers only, to complete the flowchart.



[4]

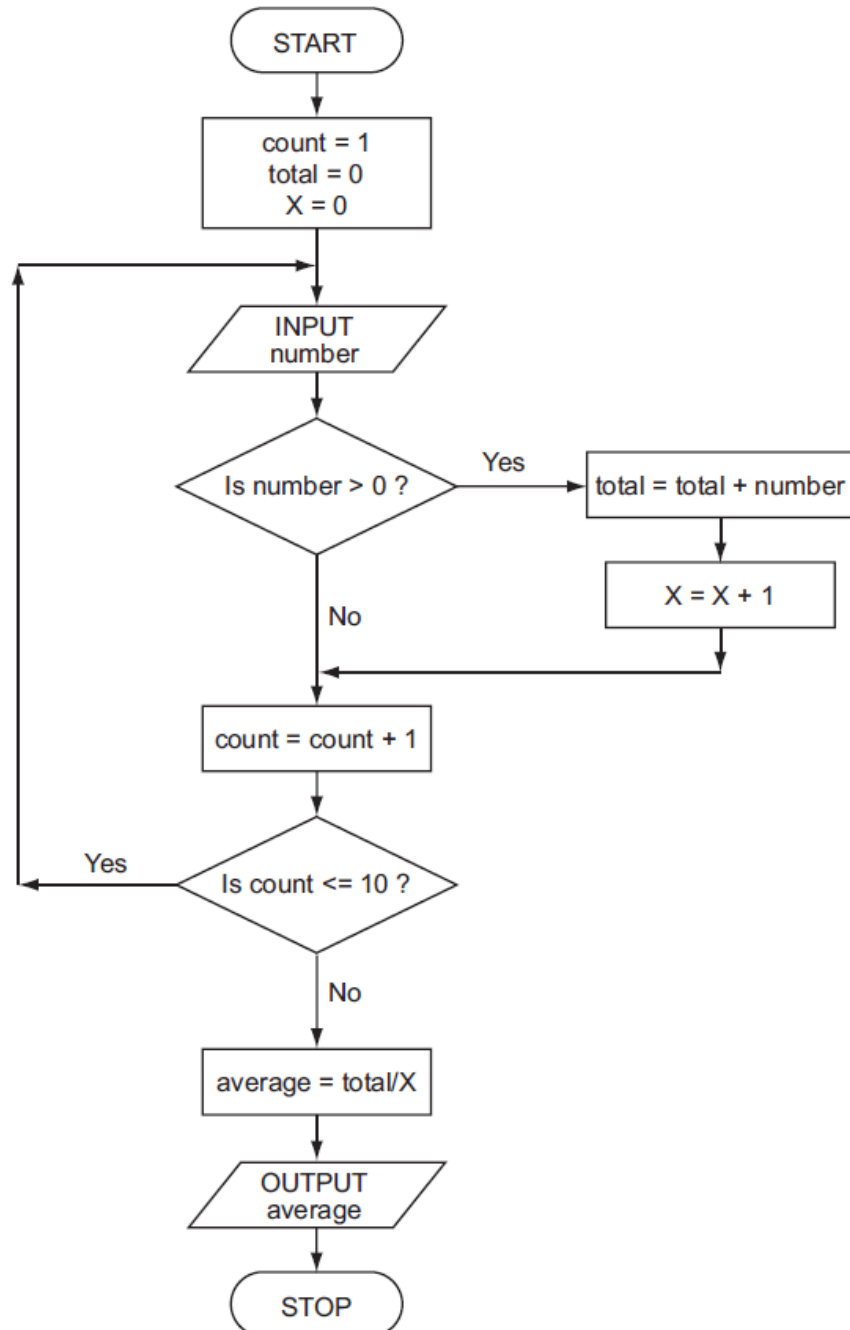


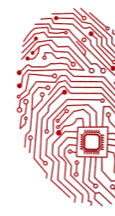


Topic: 2.1 Algorithm design and problem-solving

May/June 2011. P11

5 Study the following flowchart very carefully:





Topic: 2.1 Algorithm design and problem-solving

(a) Complete the trace table for the following data set:

15, -2, 0, 8, 0, 21, -8, -12, 1, 25

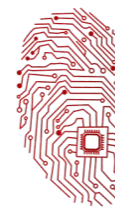
count	number	total	X	average	OUTPUT

[4]

(b) What is the purpose of this flowchart?

[1]

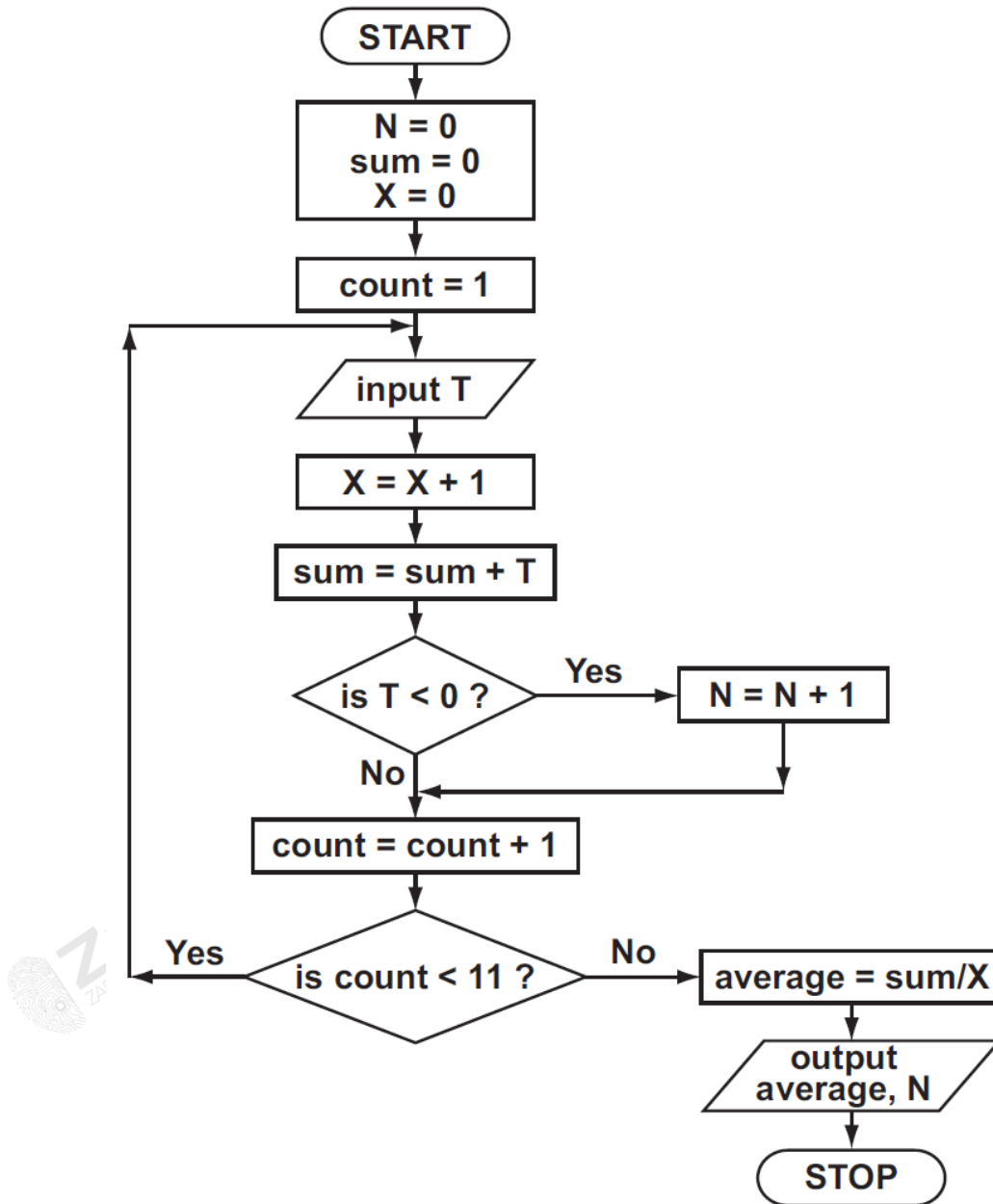


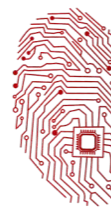


Topic: 2.1 Algorithm design and problem-solving

May/June 2011. P12

10 The following flowchart inputs ten temperatures and outputs the average (mean) temperature and the number of temperatures which were negative (i.e. < 0).





Topic: 2.1 Algorithm design and problem-solving

(a) Complete the trace table for this flowchart using the following test data:

5, 11, 16, -4, -10, 8, 10, -3, 17, 10

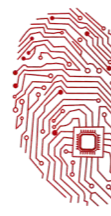
N	sum	X	count	T	average

[6]

(b) What values are output from the flowchart using the above test data?

[1]



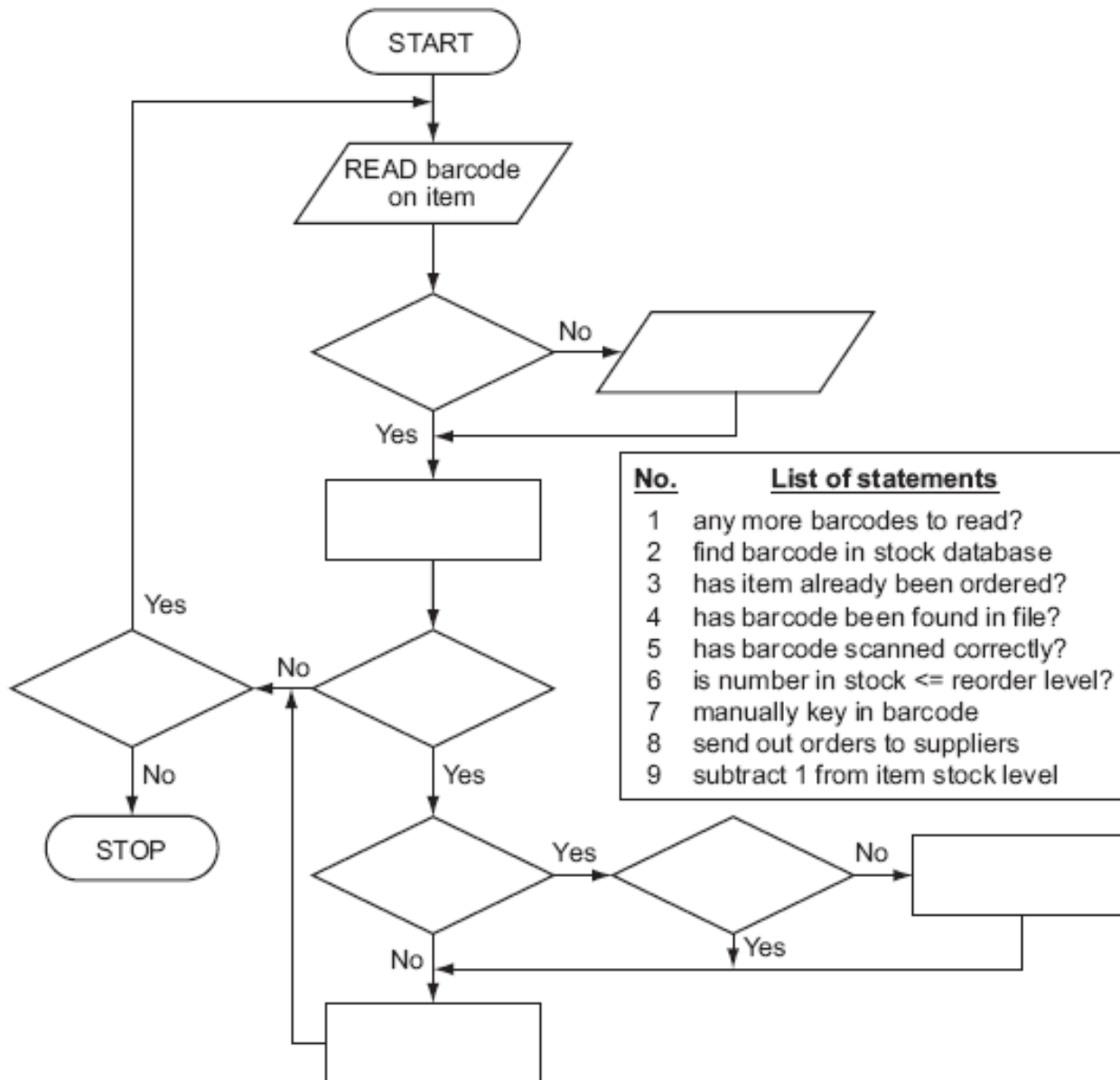


Topic: 2.1 Algorithm design and problem-solving

Oct/Nov 2011. P11

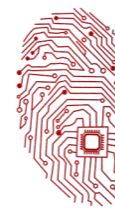
4 The following flowchart shows how barcodes are used at the point of sale in an automatic stock control system.

Select statements from the list below, using numbers only, to complete the flowchart.



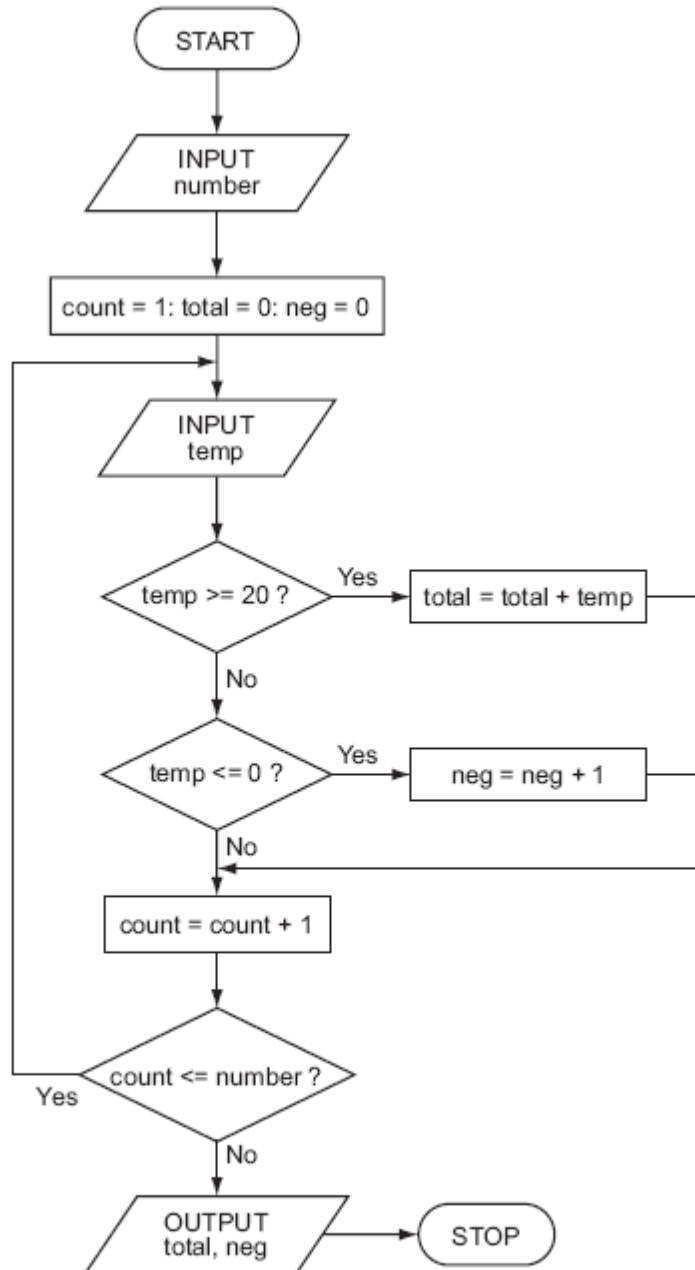
[5]





Topic: 2.1 Algorithm design and problem-solving

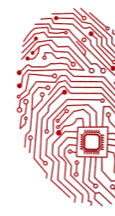
7 Carefully study the following flowchart:



Complete the trace tables for the following two sets of test data:

- (i) number = 7, temp = -5, 0, 5, -4, 0, 10, -2
- (ii) number = 6, temp = 21, 20, 30, 19, 21, 15



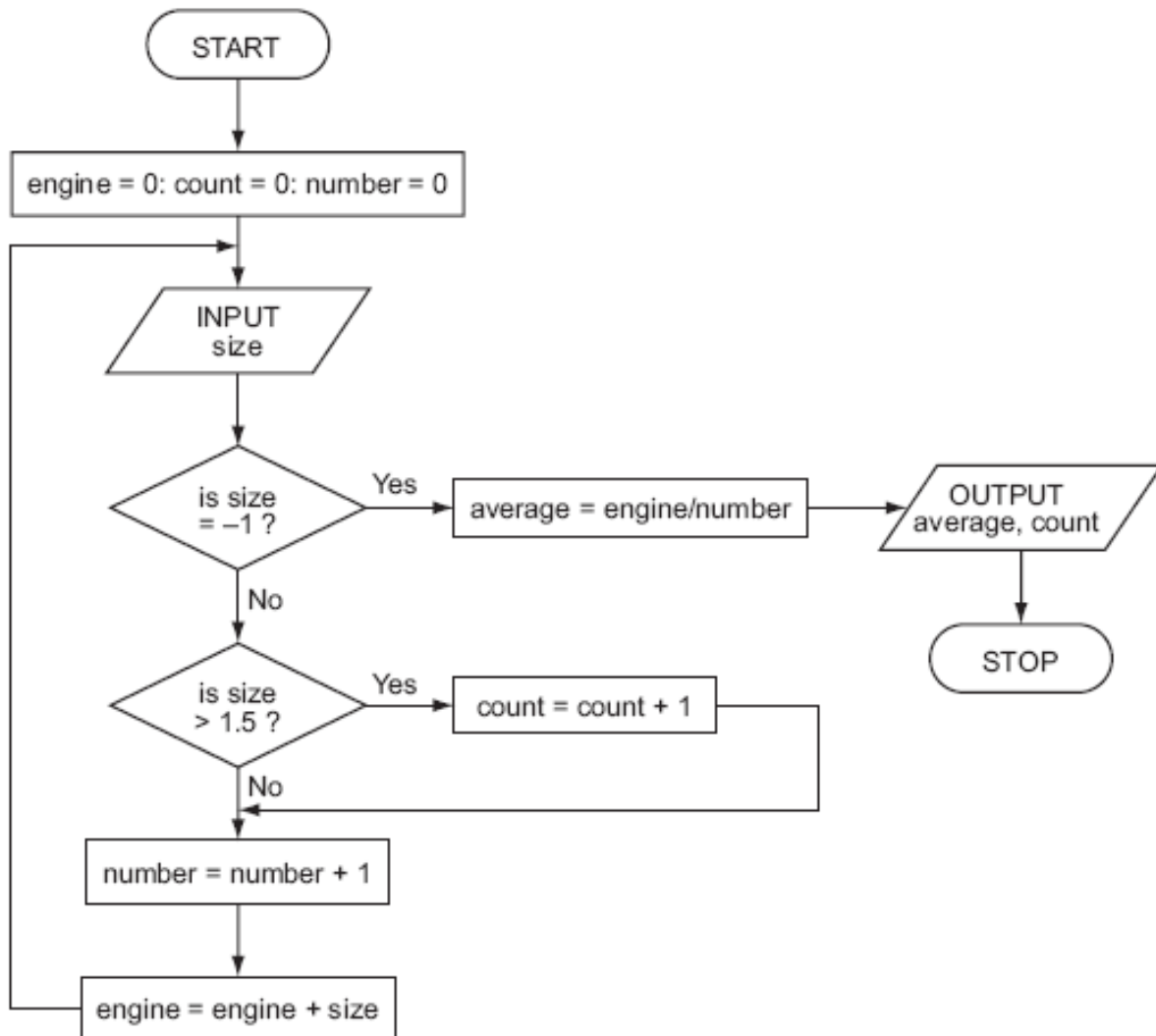


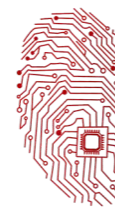
Topic: 2.1 Algorithm design and problem-solving

Oct/Nov 2011. P13

- 7 The following flowchart inputs the size of a number of car engines; a value of -1 stops the input.

The following information is output: *average engine size and number of engines with size > 1.5.*

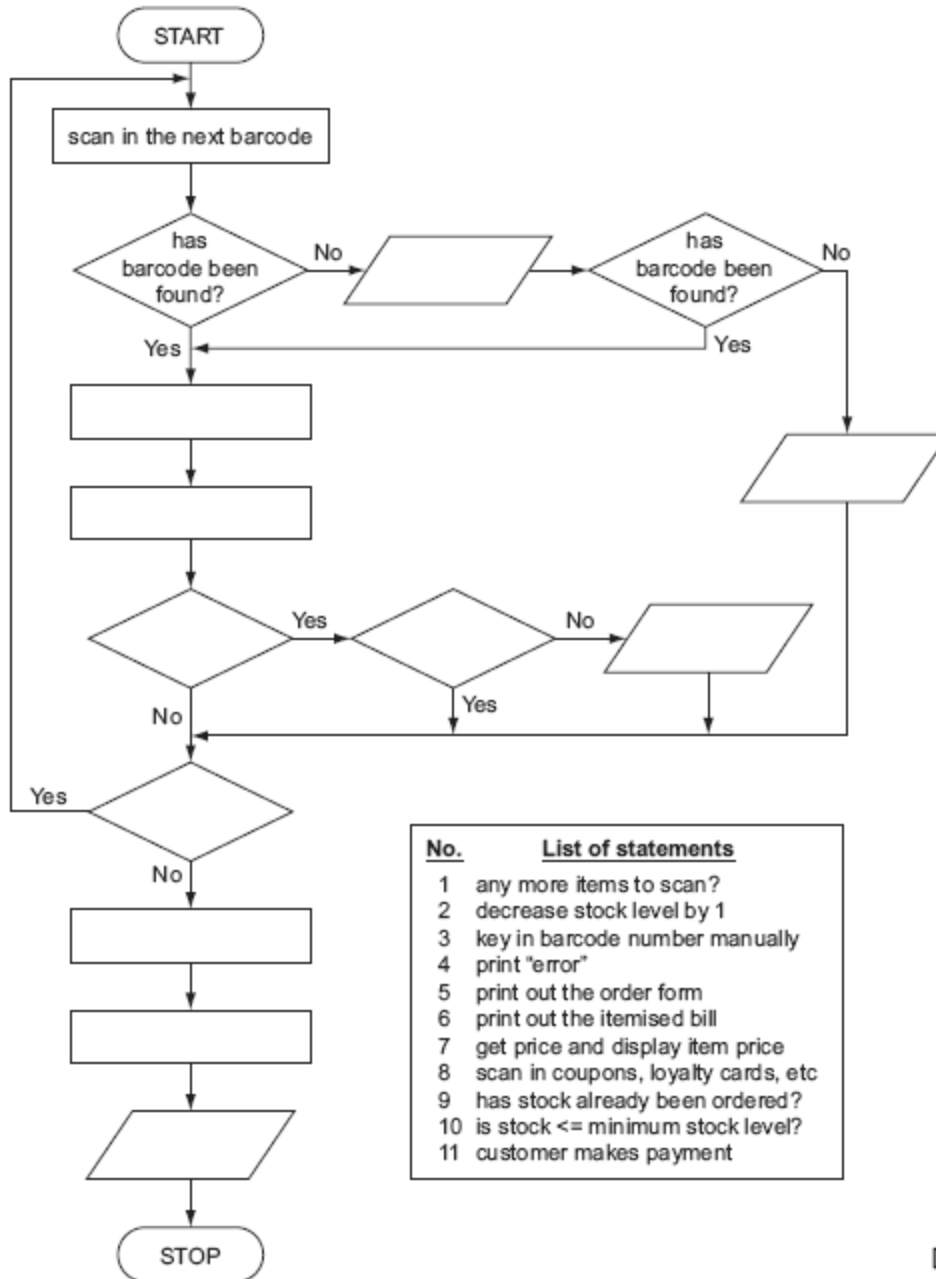




Topic: 2.1 Algorithm design and problem-solving

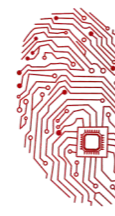
13 The following flowchart shows how barcodes are used when a customer buys items from the supermarket. Barcodes are used to find the prices and to carry out stock control. Several stages are missing from the flowchart. These stages are shown in the item list below.

Insert the correct statements, using numbers only, to complete the flowchart.



[5]

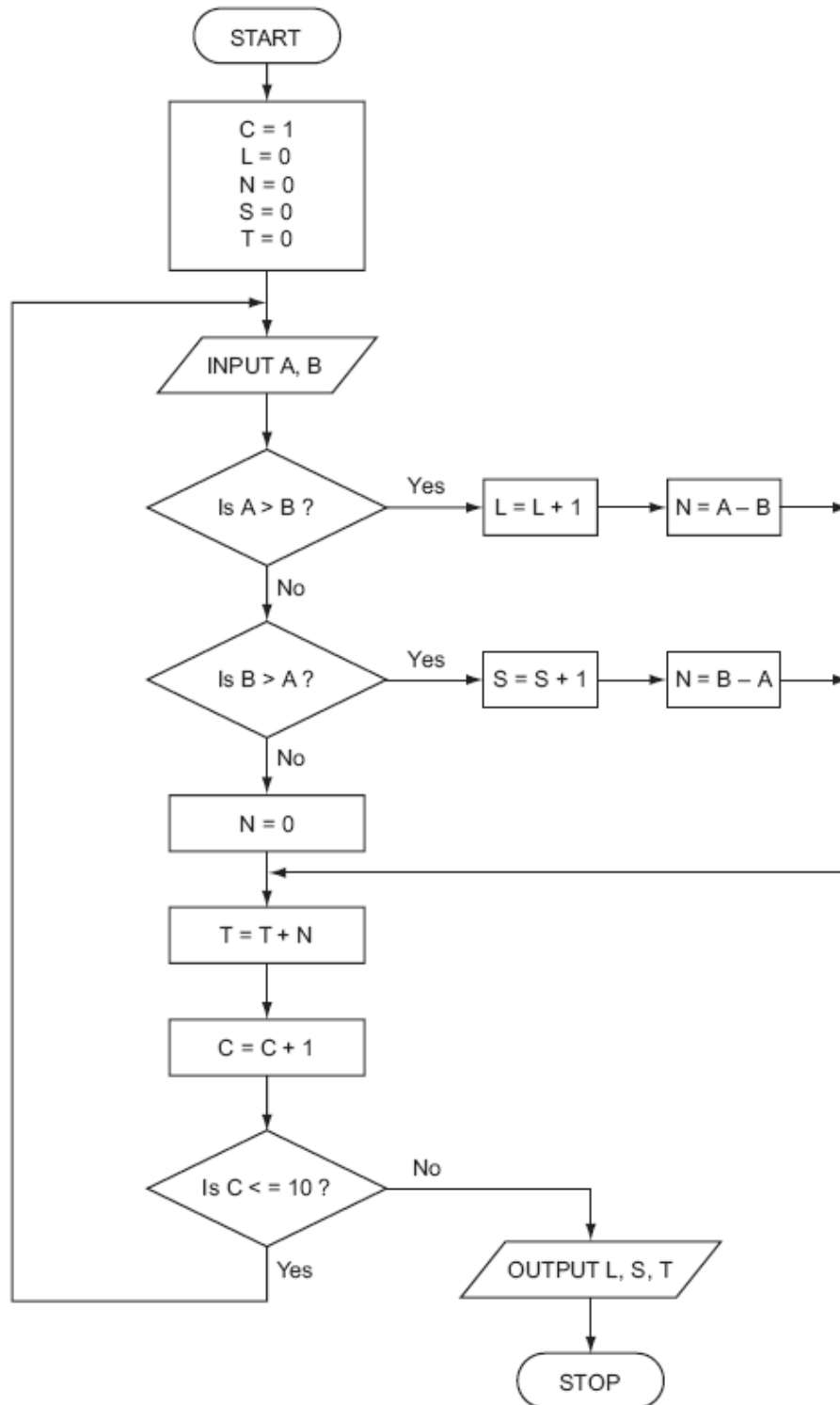




Topic: 2.1 Algorithm design and problem-solving

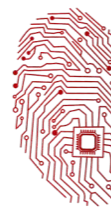
May/June 2012. P11

6 Carefully study the following flowchart.



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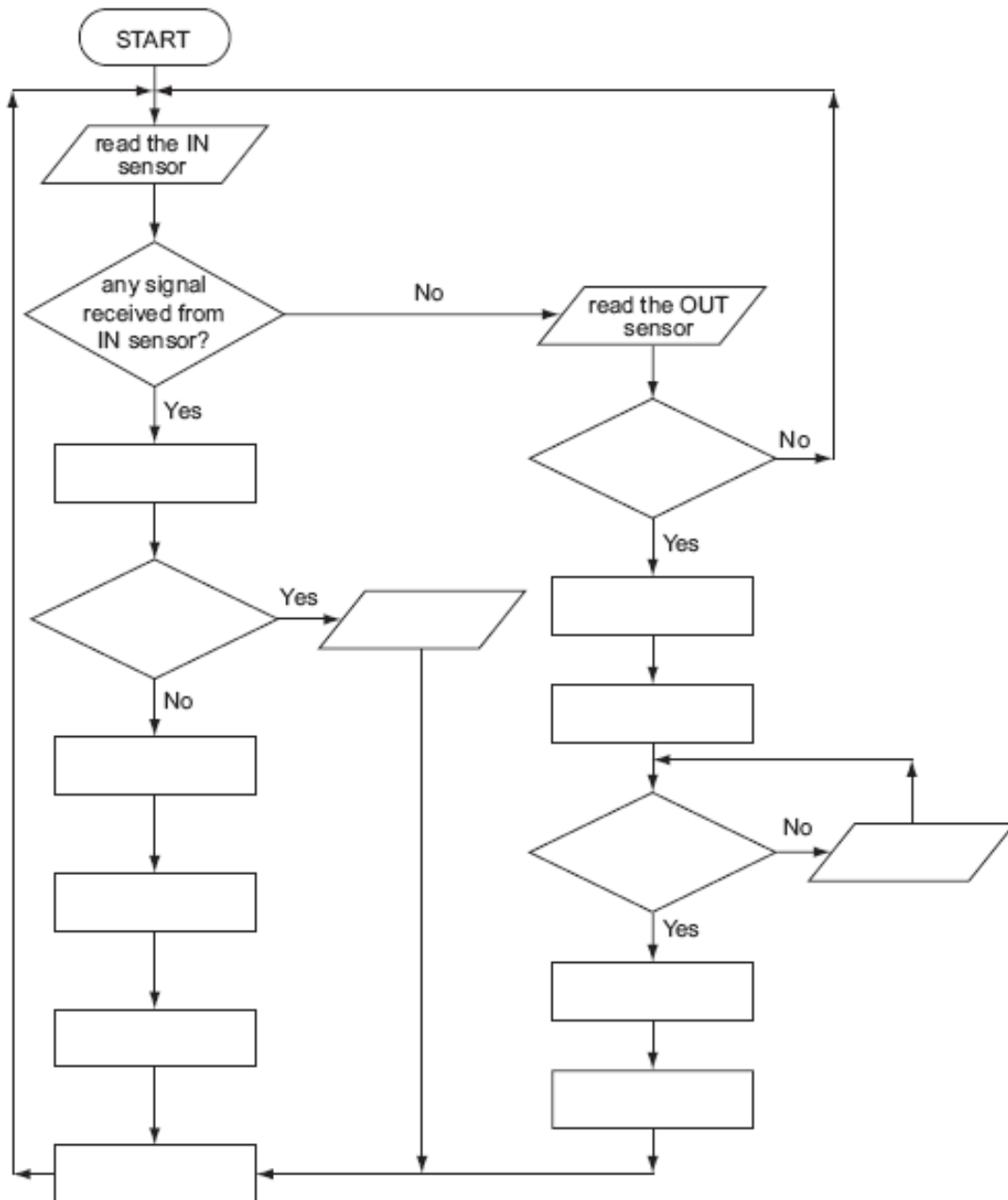


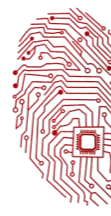
Topic: 2.1 Algorithm design and problem-solving

16 A car park uses sensors and a microprocessor to monitor cars leaving and entering. The car park is open 24 hours every day. The parking fee is \$10 per day.

The following flowchart shows how the IN and OUT barriers are controlled. Some of the statements are missing.

Using item numbers only, insert the correct item numbers into the flowchart from the item list.





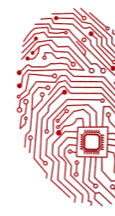
Topic: 2.1 Algorithm design and problem-solving

List of statements

Item Number	Description
1	activate motor to raise IN barrier
2	activate motor to raise OUT barrier
3	any signal received from OUT sensor?
4	decrease number of cars in car park by 1
5	increase number of cars in car park by 1
6	is car park full?
7	is the car park fee paid?
8	OUTPUT "car park full"
9	OUTPUT "please pay car park fee at pay machine"
10	use ADC to convert IN sensor signal to digital
11	use ADC to convert OUT sensor signal to digital
12	use DAC to convert computer signal to analogue signal to operate IN barrier
13	use DAC to convert computer signal to analogue signal to operate OUT barrier
14	wait 30 seconds and then close barrier

[6]

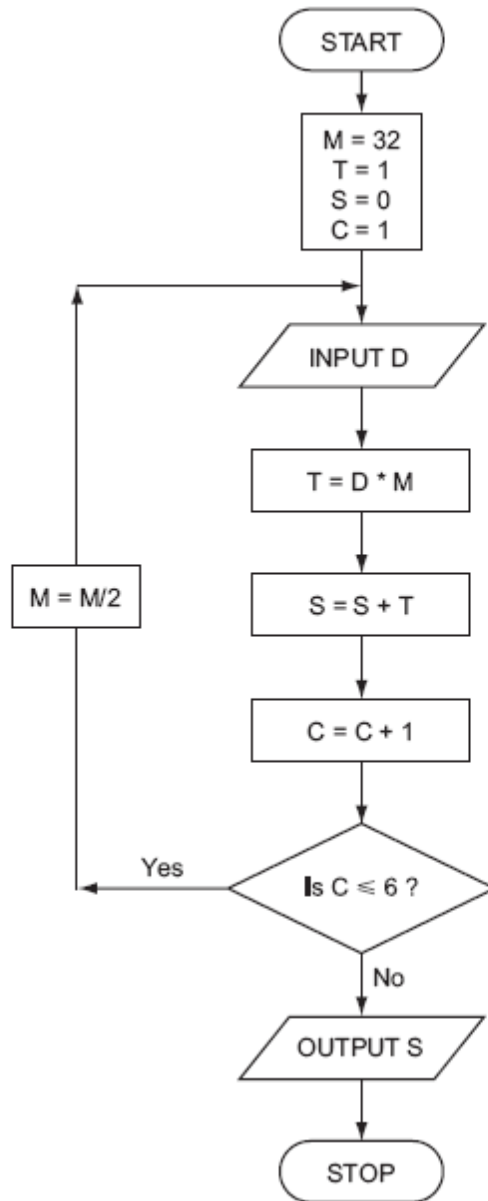




Topic: 2.1 Algorithm design and problem-solving

May/June 2012. P12

6 Carefully study the following flowchart:





Topic: 2.1 Algorithm design and problem-solving

(a) Complete the trace table for the following data:

1, 0, 1, 1, 0, 1

M	T	S	C	D

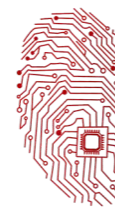
[4]

(b) What process does this flowchart perform?

.....
.....
..... [1]

(c) Predict the output from the flowchart for an input of 1, 1, 1, 1, 0, 0

.....
..... [1]



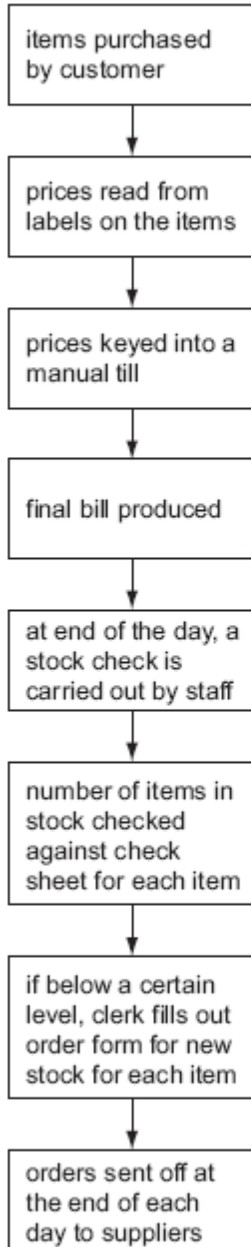
Topic: 2.1 Algorithm design and problem-solving

Oct/Nov 2012. P12

5

Flowchart A

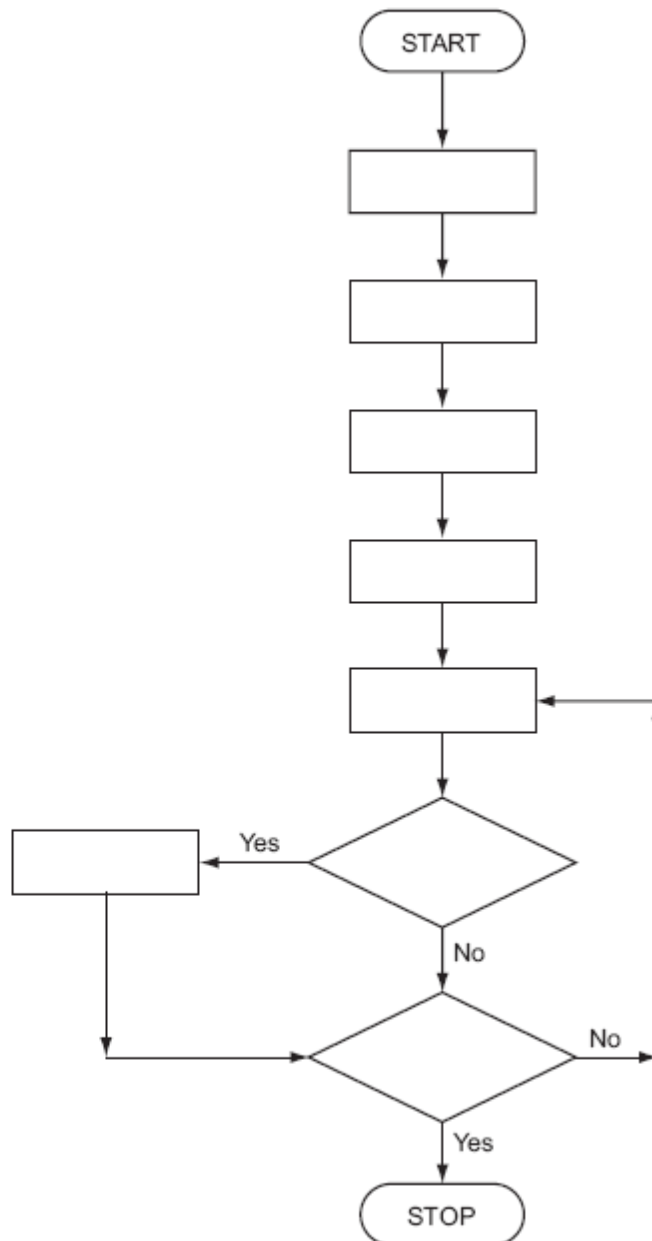
shows an existing manual system used by a shop to calculate a customer's bill and carry out stock control.



existing manual system

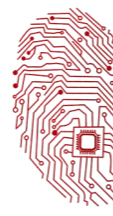
Flowchart B

shows the intended automatic computer-controlled system.



intended automatic computerised system





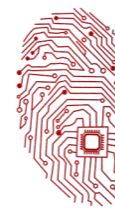
Topic: 2.1 Algorithm design and problem-solving

Using item numbers only from the following list, complete **Flowchart B**.

Item Number	Description
1	each item quantity reduced by 1 on the database
2	is stock level of item \leq re-order level?
3	item price found on database
4	quantity of stock item checked against re-order level at end of the day
5	order for new stock of each item automatically sent out
6	barcode on each item scanned
7	have all items been checked?
8	an itemised bill is produced

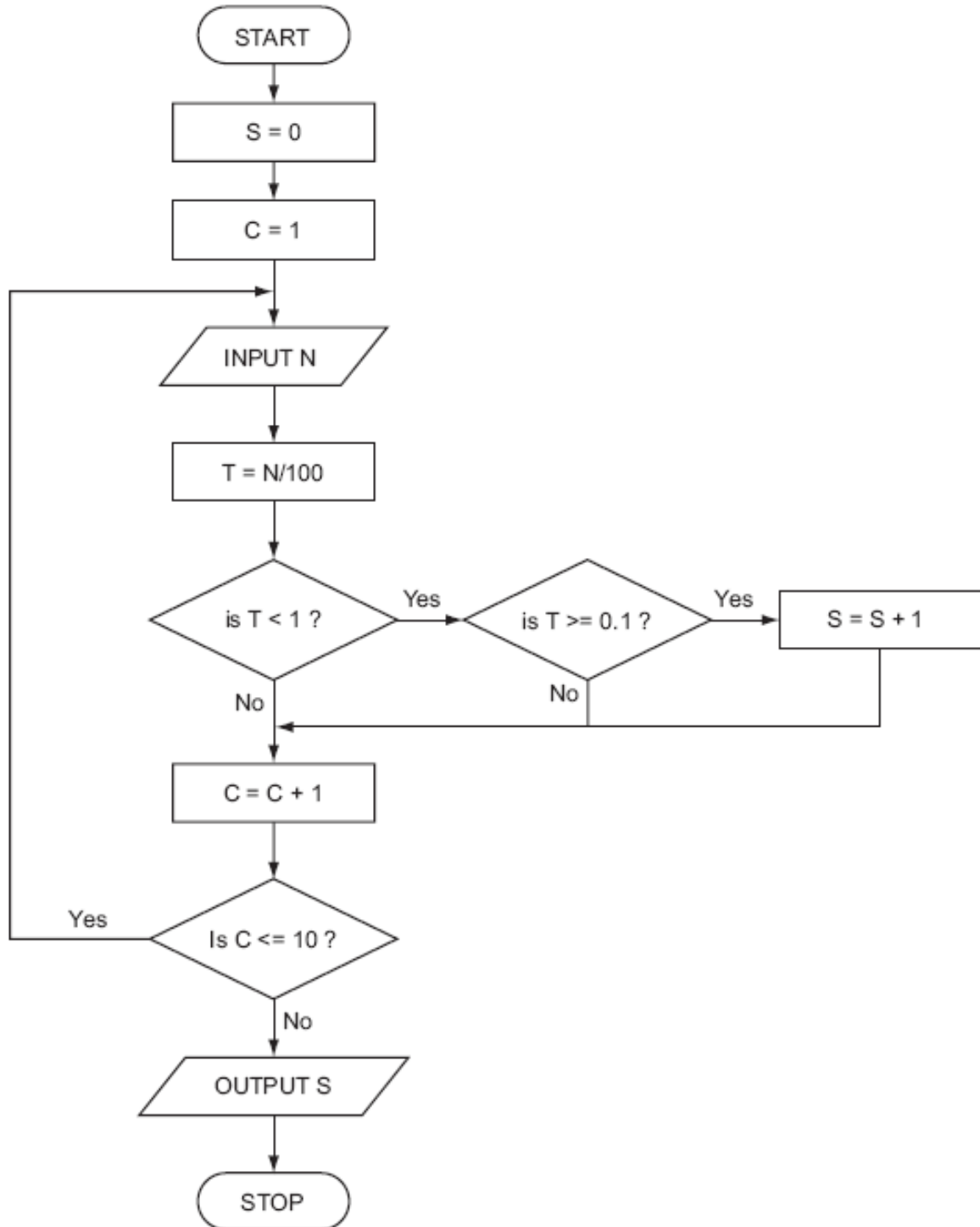
[4]





Topic: 2.1 Algorithm design and problem-solving

14 Study the following flowchart very carefully.

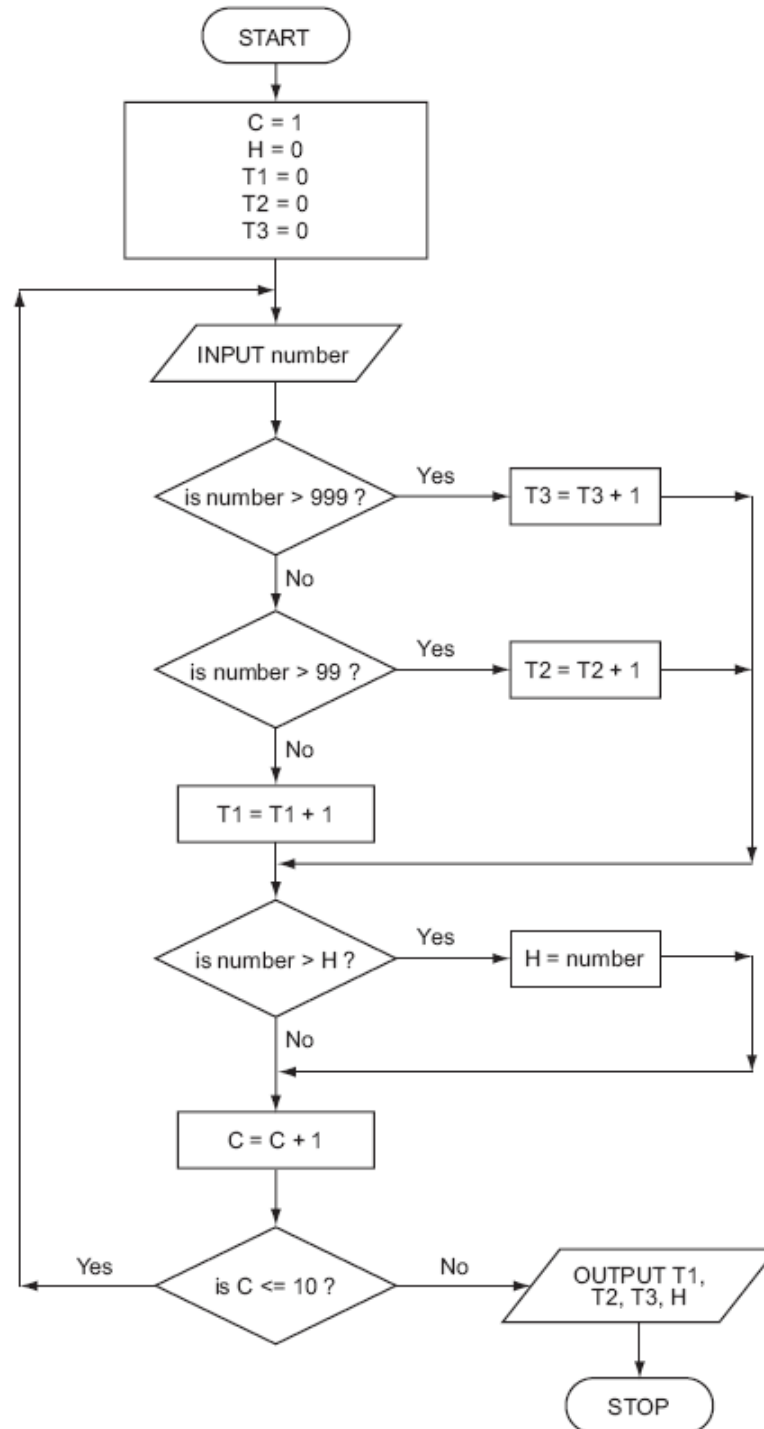




Topic: 2.1 Algorithm design and problem-solving

Oct/Nov 2012. P13

9 Study this flowchart very carefully.



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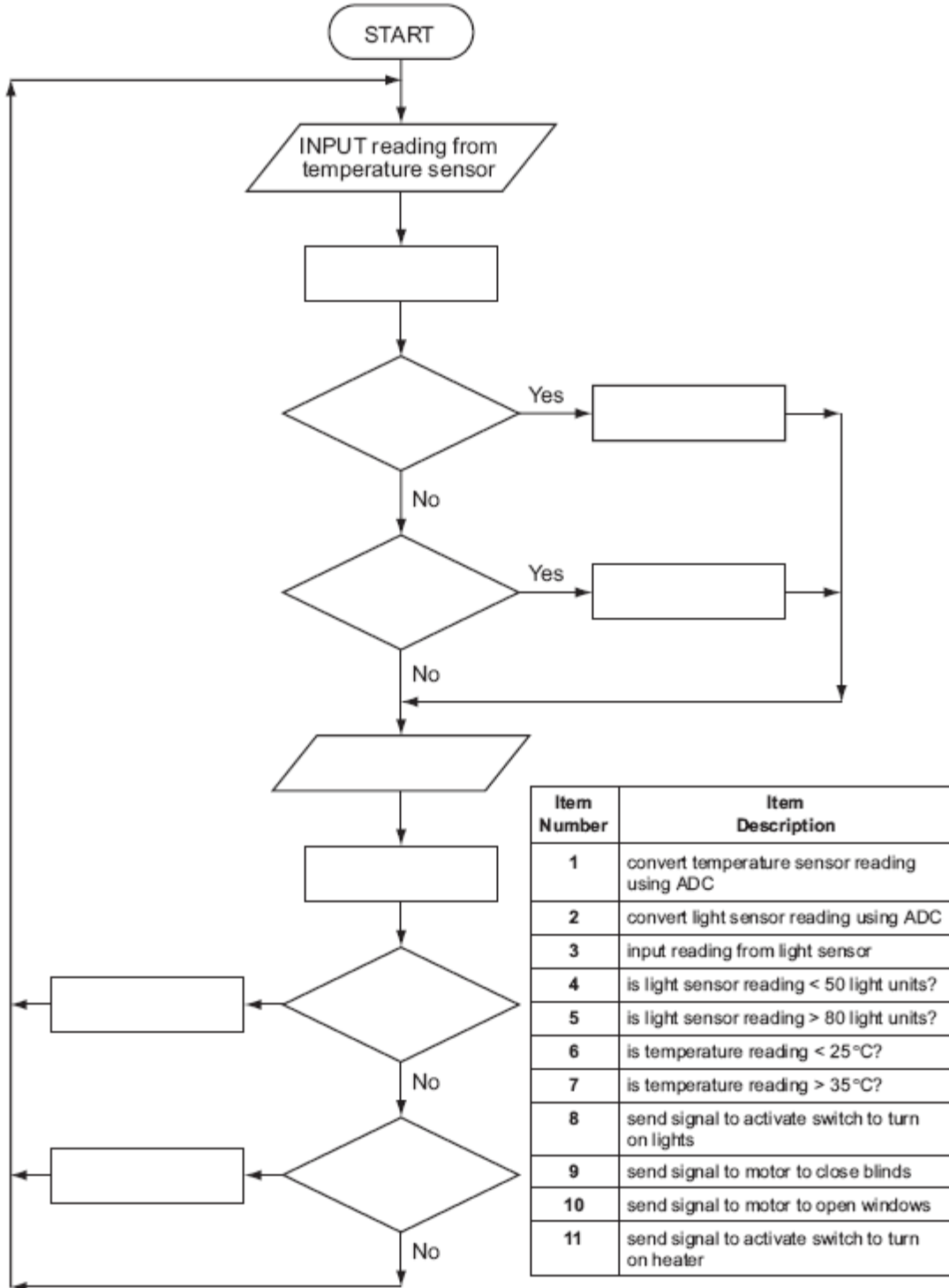




Topic: 2.1 Algorithm design and problem-solving

14 The following flowchart shows how a computer and sensors are used to control the environment in a greenhouse. Temperatures must be between 25°C and 35°C. Light must be between 50 and 80 light units.

(a) Complete the flowchart, using item number only, from the list of items given below.



[5]



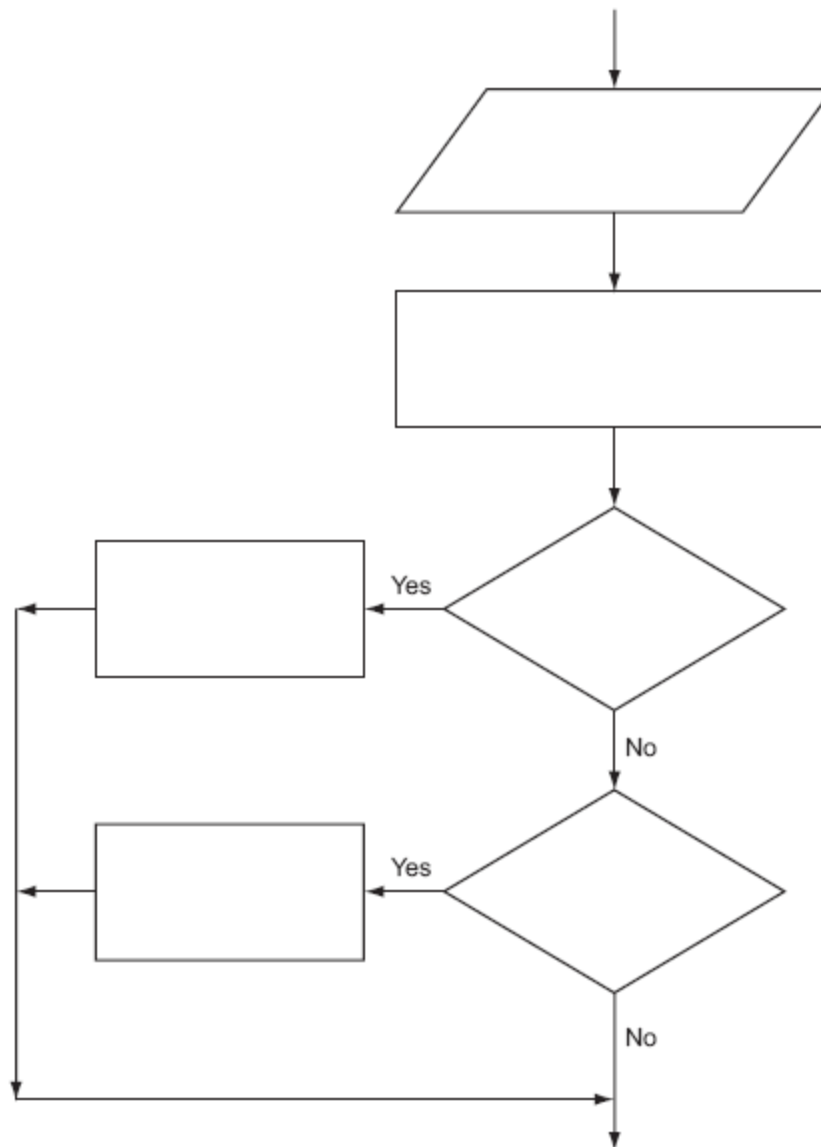


Topic: 2.1 Algorithm design and problem-solving

(b) The computer also checks on humidity levels (using humidity sensors) which must be between the values of 40 and 90.

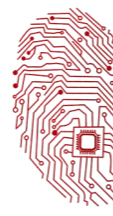
If humidity is too low, water is sprayed into the air.
If humidity is too high, fresh air is allowed to enter.

Write the necessary commands in the following flowchart section to show how the humidity levels are controlled:



[4]





Topic: 2.1 Algorithm design and problem-solving

May/June 2013. P11

13 A customer uses Internet banking. To gain access to their account they need:

- an 8-digit ID
- a 4-digit PIN
- a 10-character password

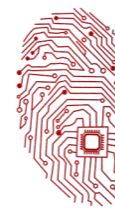
They will be asked to type in their ID, then 3 digits from their PIN and finally 3 characters from their password. Three attempts at the ID are allowed, but only one attempt at the PIN and at the password.

The flowchart on the next page shows the access process described above. However, most of the stages have been omitted.

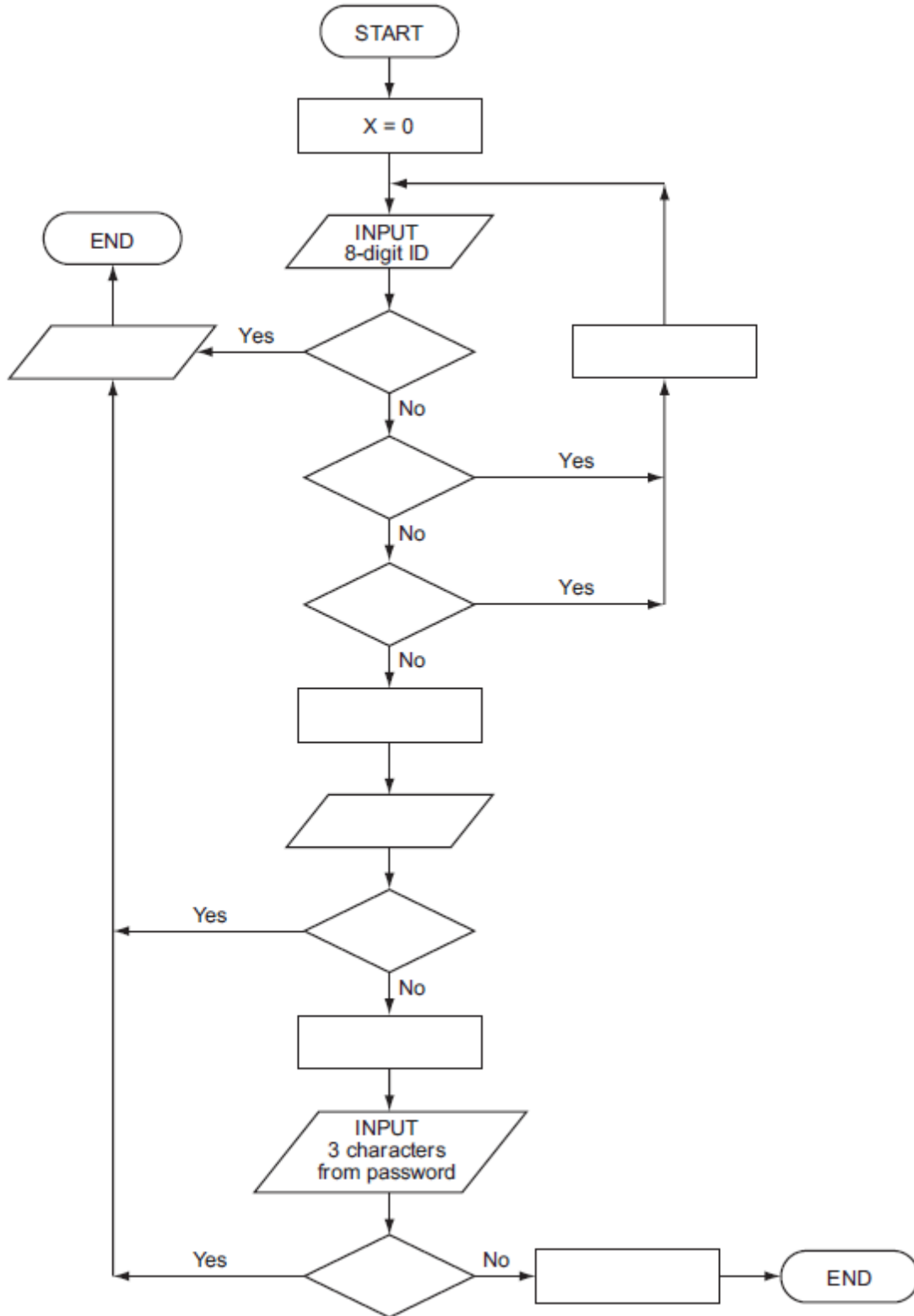
Complete the flowchart, **using item number only**, from the list of items given.

Item number	Item description
1	access to account allowed
2	are any characters in the password incorrect?
3	are any digits in the ID incorrect?
4	are any digits in the PIN incorrect?
5	generate three random digits from the PIN
6	generate three random characters from the password
7	input the required three digits from the PIN
8	is number of digits < 8 or number of digits > 8?
9	is $X > 2$?
10	output "access to account denied"
11	$X = X + 1$



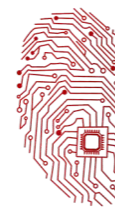


Topic: 2.1 Algorithm design and problem-solving



[6]

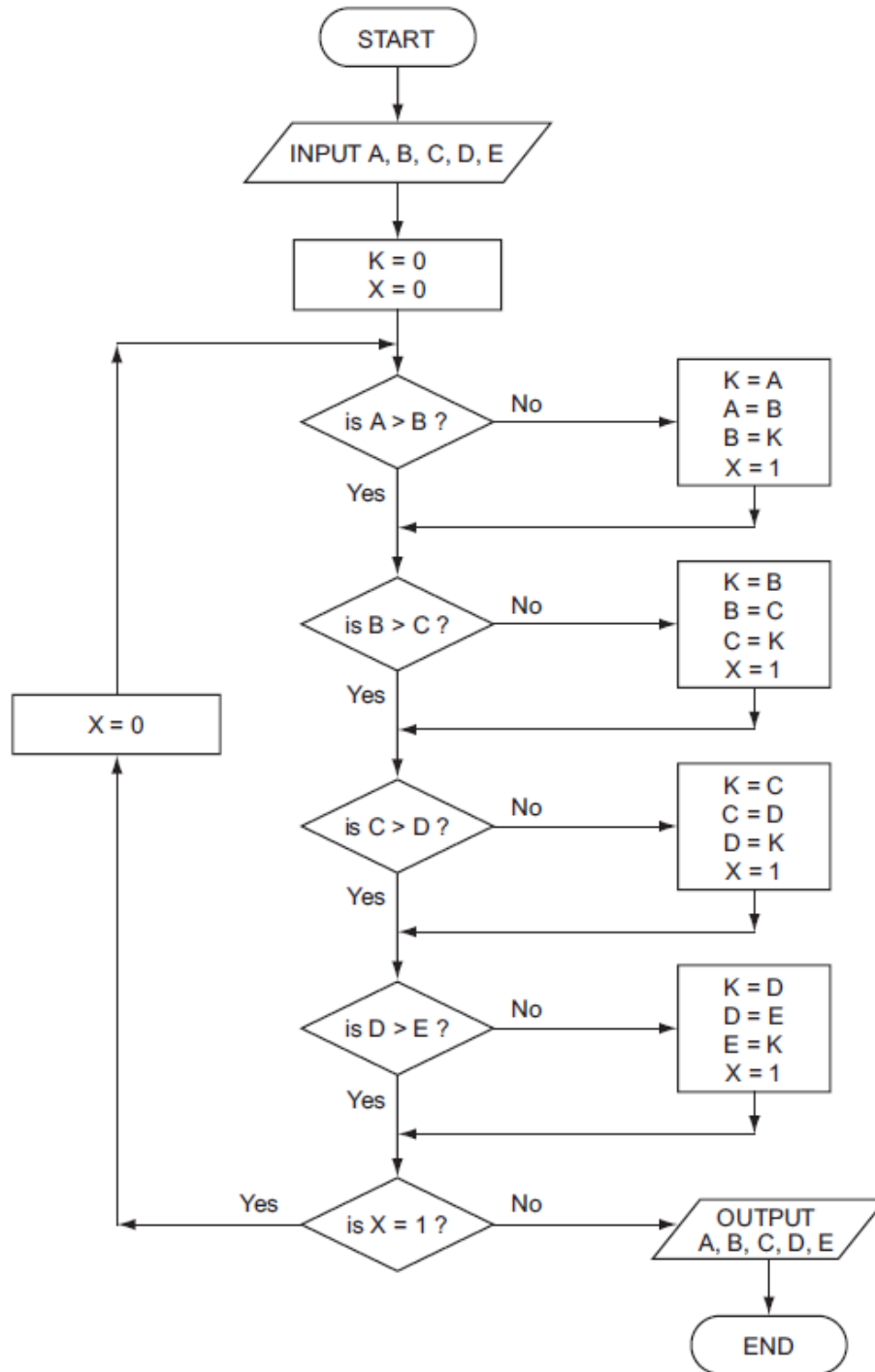




Topic: 2.1 Algorithm design and problem-solving

May/June 2013. P12

12 Study the following flowchart very carefully.





Topic: 2.1 Algorithm design and problem-solving

(b) What values are output from the flowchart using the above test data?

.....
..... [1]

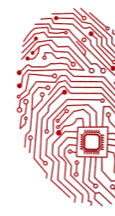
(c) What function is this flowchart carrying out?

..... [1]

(d) What would happen if the value of X wasn't set to 0 in the return loop of the flowchart?

.....
..... [1]



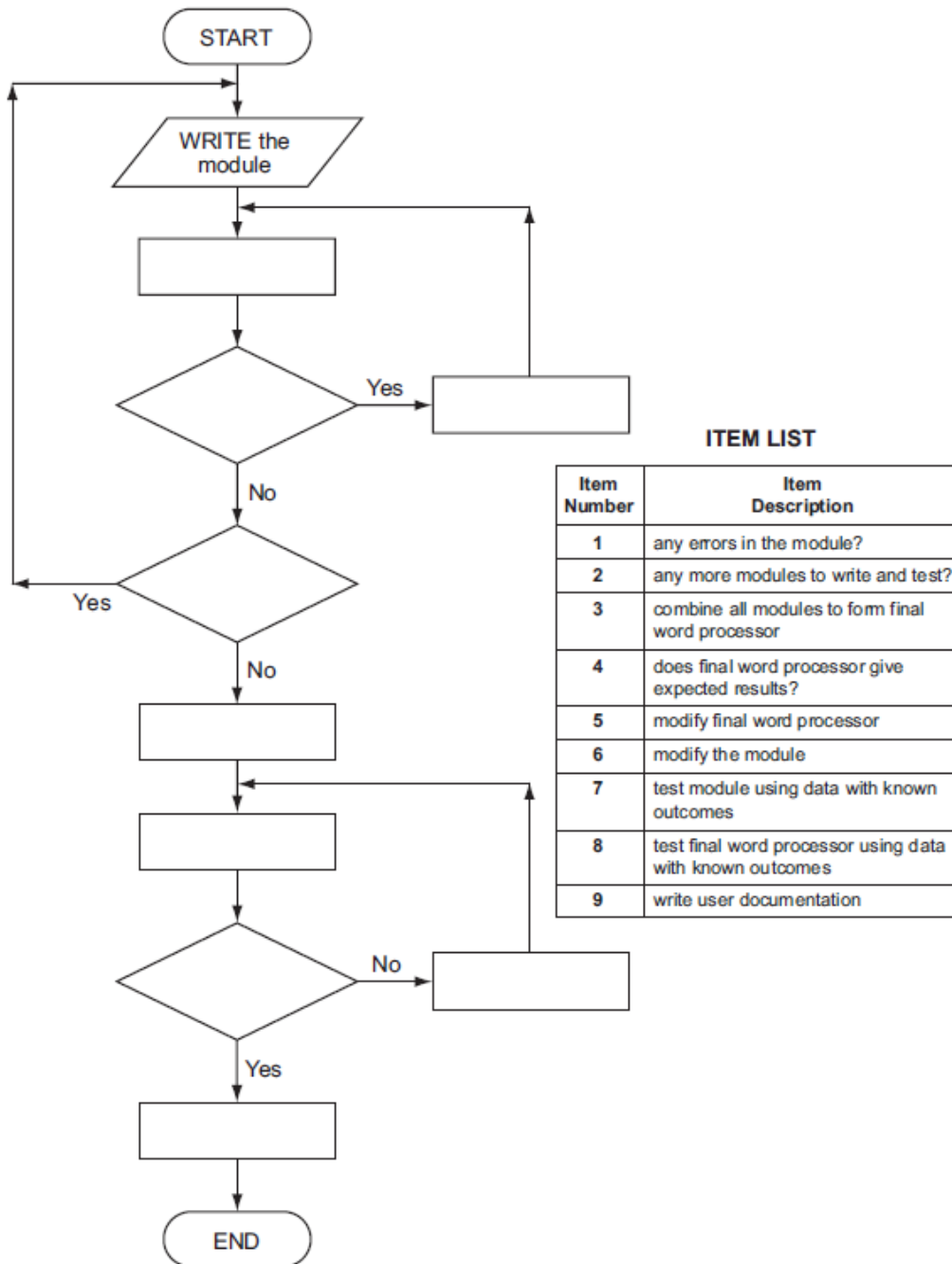


Topic: 2.1 Algorithm design and problem-solving

May/June 2013. P12

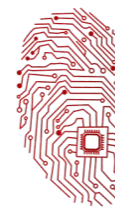
16 A large word processor is being developed by first writing a series of modules. These are then put together to form the final word processor. Testing is done on each module and on the final word processor. The following flowchart shows how this word processor is developed. Several of the stages have been omitted.

Complete the flowchart, using item number only, from the list of items given.



[5]

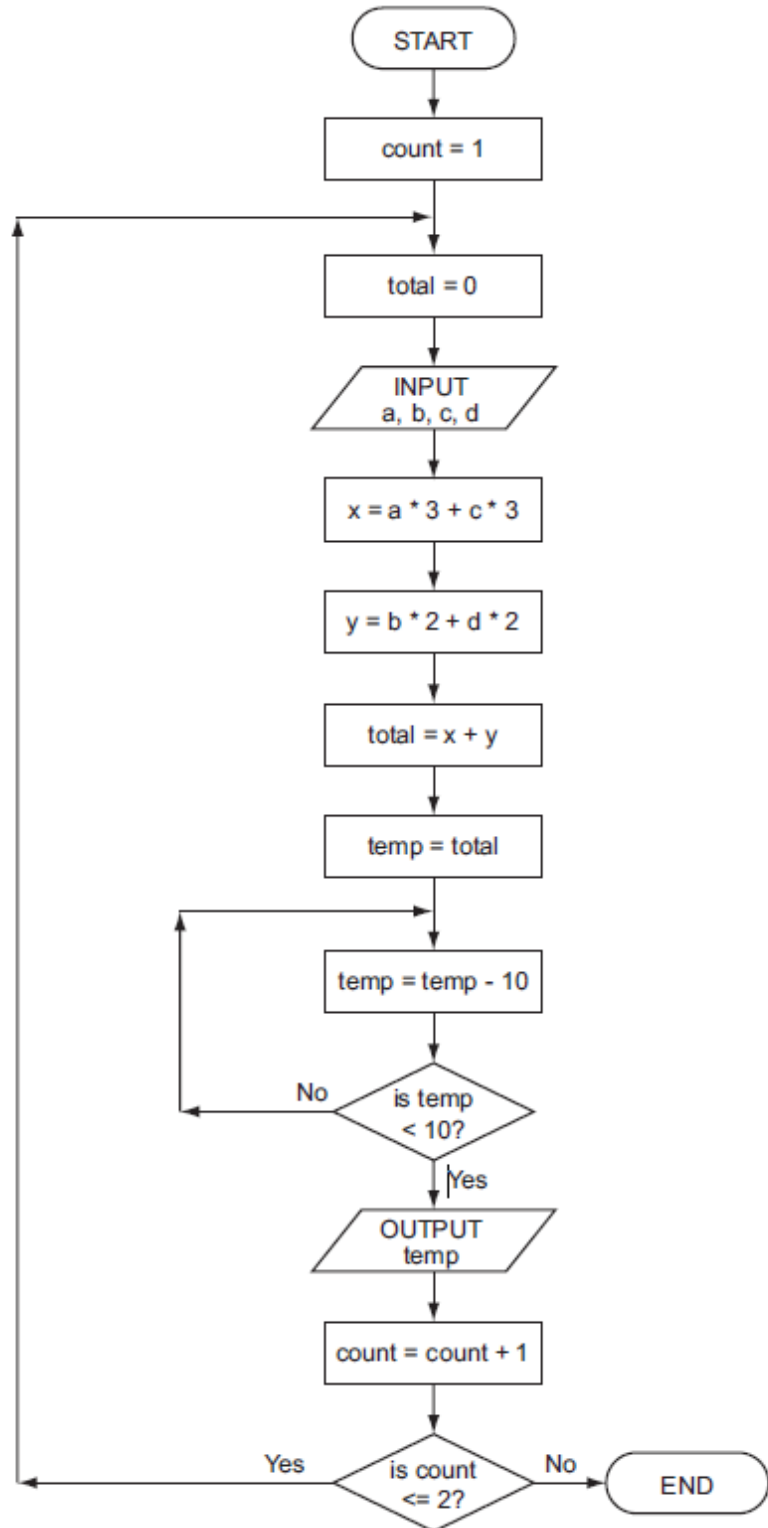


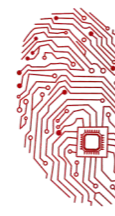


Topic: 2.1 Algorithm design and problem-solving

Oct/Nov 2013. P12

5 Study the following flowchart very carefully





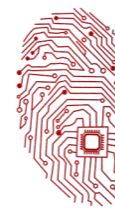
Topic: 2.1 Algorithm design and problem-solving

- 15** A library uses barcodes to identify borrowers and books. A borrower has a card containing a barcode with an equivalent numerical code. Each book also has a barcode with an equivalent numerical code. The flowchart on the facing page shows what happens when book(s) are taken out by a borrower. However, several stages are missing. Using item numbers only, complete the flowchart by selecting stages from the item list below.

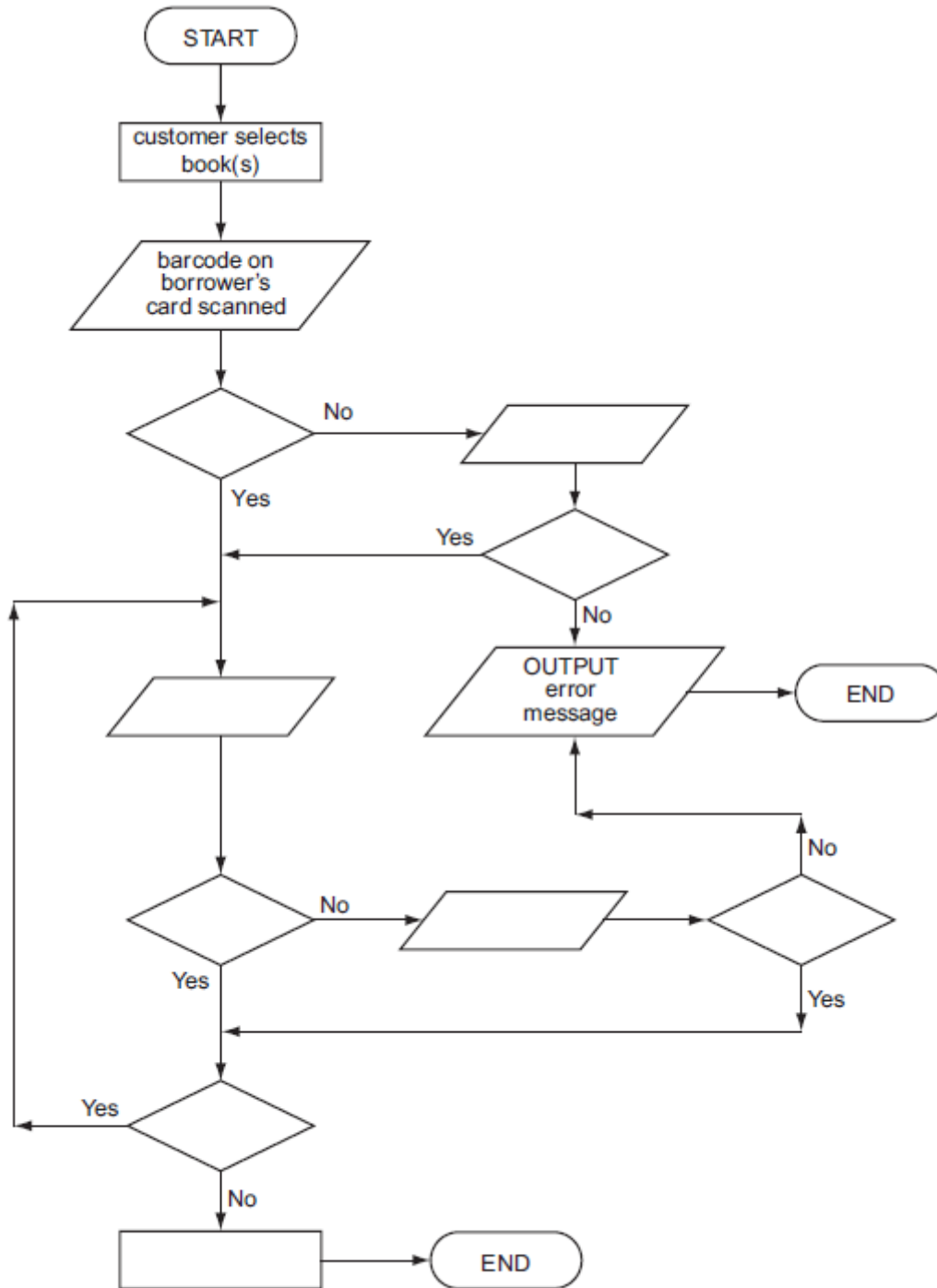
Item List

Item Number	Item Description
1	any more books to scan?
2	has book's barcode been recognised?
3	has book's numeric code been recognised?
4	has borrower's barcode been recognised?
5	has borrower's numeric code been recognised?
6	input book's numeric code manually
7	input borrower's numeric code manually
8	scan in barcode shown in book
9	update borrower and book files



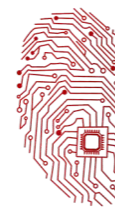


Topic: 2.1 Algorithm design and problem-solving



[6]





Topic: 2.1 Algorithm design and problem-solving

Oct/Nov 2013. P13

14 A microprocessor controls the opening and closing of automatic doors to a supermarket. Customers are detected using pressure sensors.

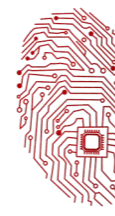
The flowchart on the next page shows how the sensors and microprocessor interact to control the opening and closing of the doors. However, several of the stages in the process have been missed out.

Using item number only, complete the flowchart using items from the following list:

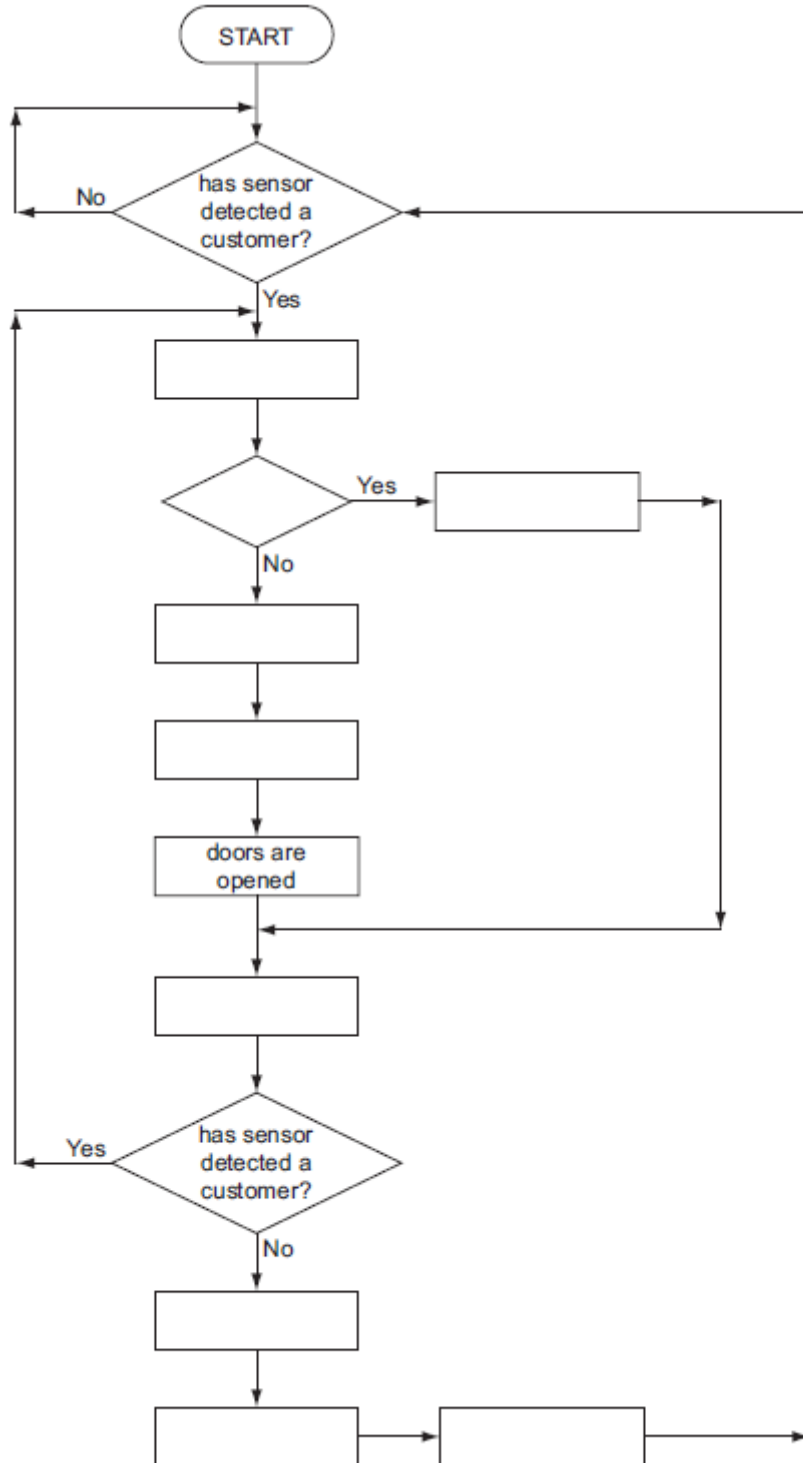
Item number	Item description
1	ADC changes analogue signal into digital signal
2	are the doors already open?
3	DAC changes digital signal into analogue signal
4	DAC changes digital signal into analogue signal
5	doors are closed
6	microprocessor sends signal
7	microprocessor sends signal
8	no action is required
9	wait for 10 seconds

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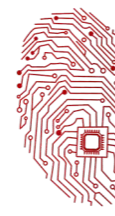


Topic: 2.1 Algorithm design and problem-solving



[5]

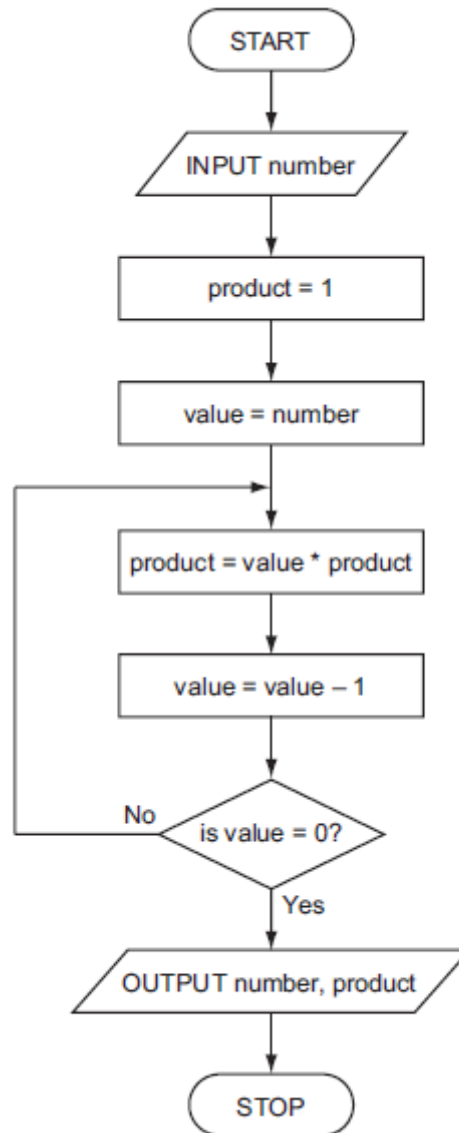


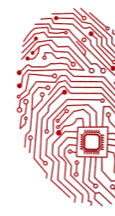


Topic: 2.1 Algorithm design and problem-solving

May/June 2014. P11

8 Study the following flowchart very carefully.





Topic: 2.1 Algorithm design and problem-solving

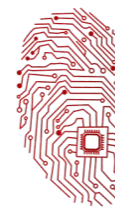
Complete the trace table for the input value of 5:

number	product	value	OUTPUT

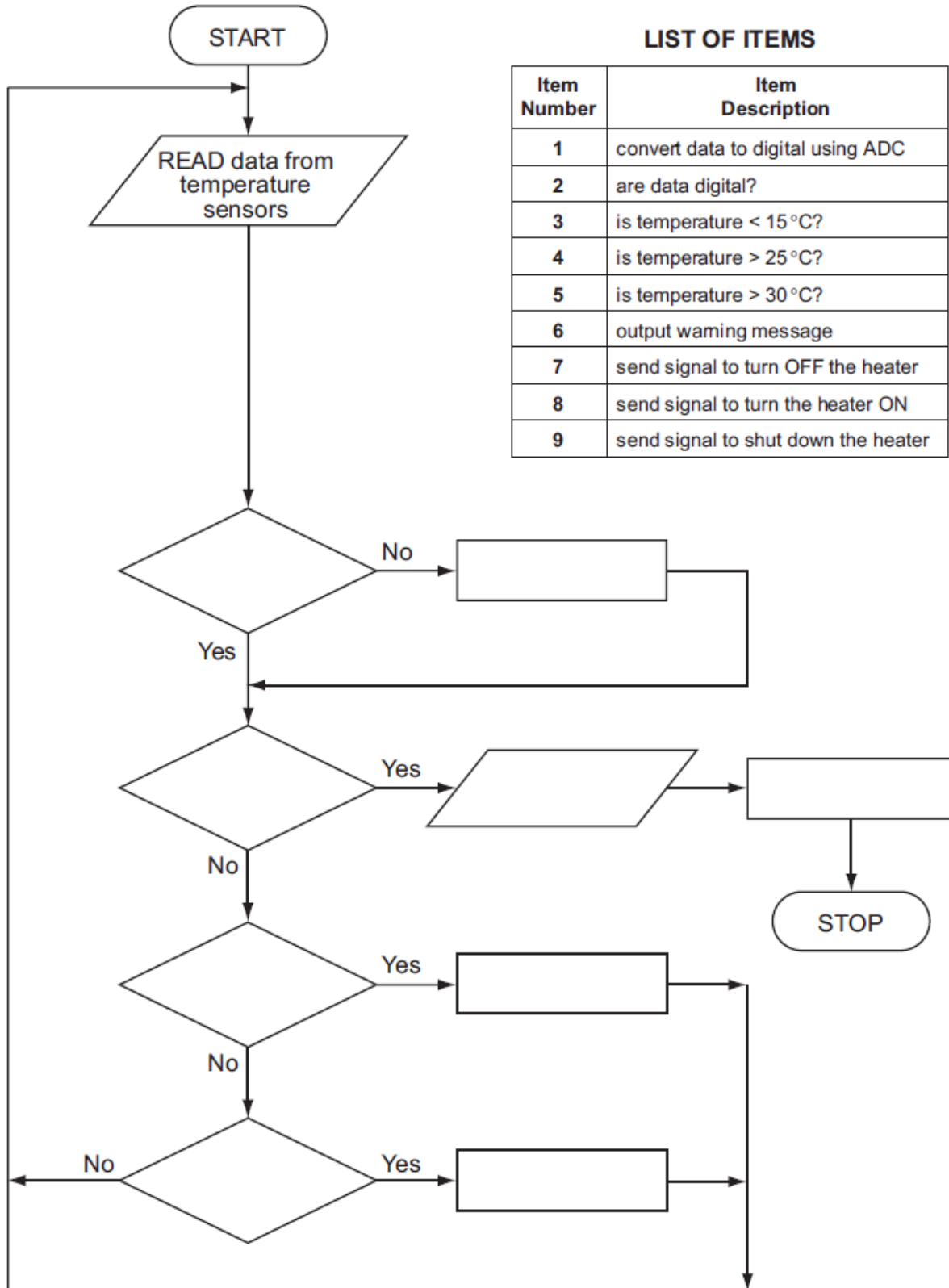
13 A heating system is being controlled by sensors and a computer. The temperature must be kept between 15°C and 25°C. If 30°C is exceeded a warning message is generated and the system shuts down.

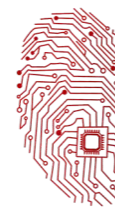
A flowchart of the process is shown below. Some of the items are missing. Complete the flowchart, using item number only, from the list of items given.





Topic: 2.1 Algorithm design and problem-solving

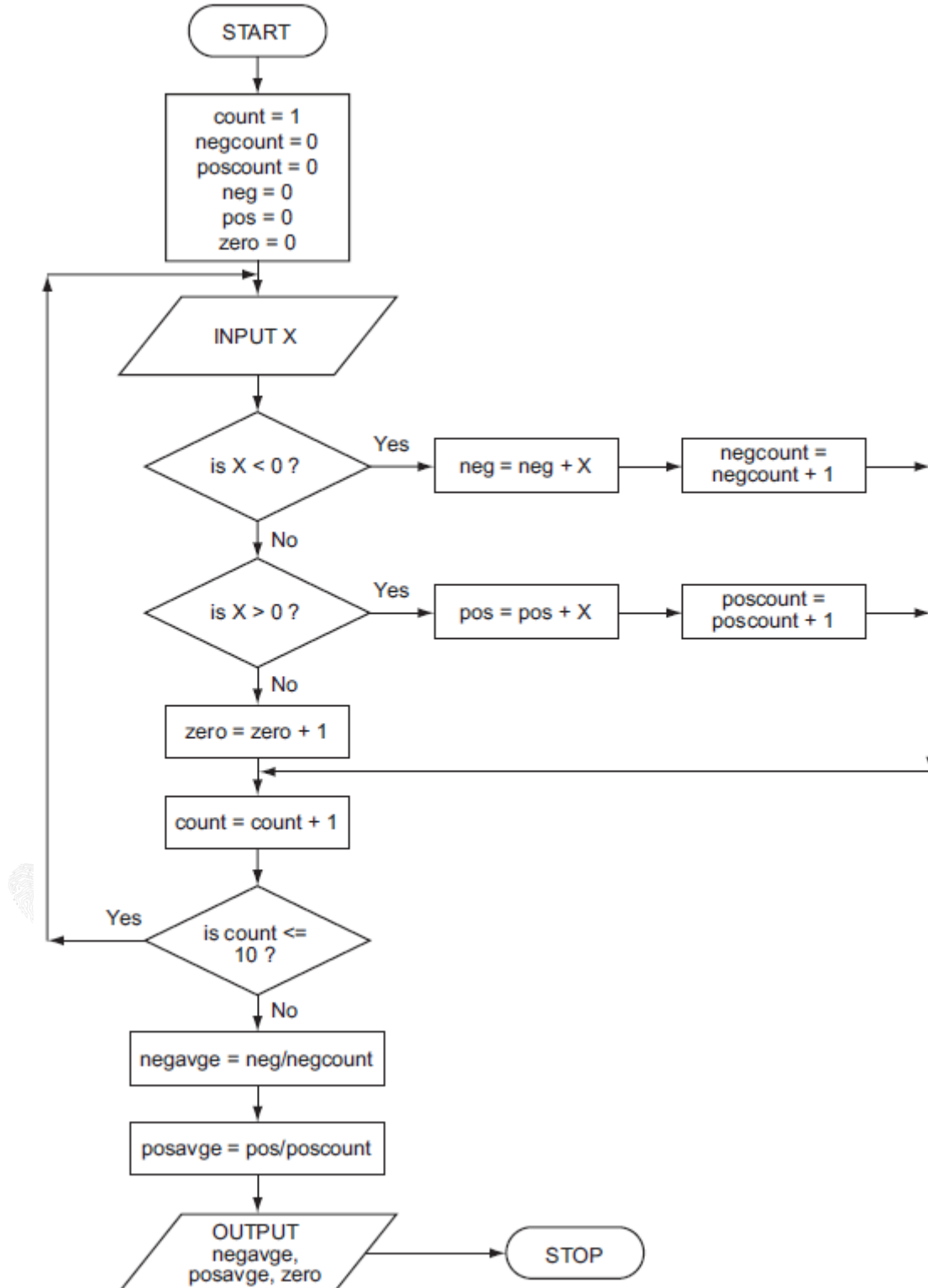


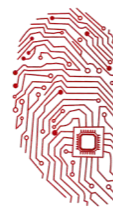


Topic: 2.1 Algorithm design and problem-solving

May/June 2014. P12

10 Study the following flowchart very carefully.





Topic: 2.1 Algorithm design and problem-solving

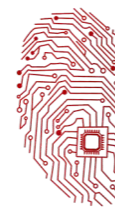
13 An algorithm has been written to check that code numbers are valid on input. They must be in the range 1000 to 9999.

Five hundred codes are being entered and the percentage of entered codes which are incorrect is output.

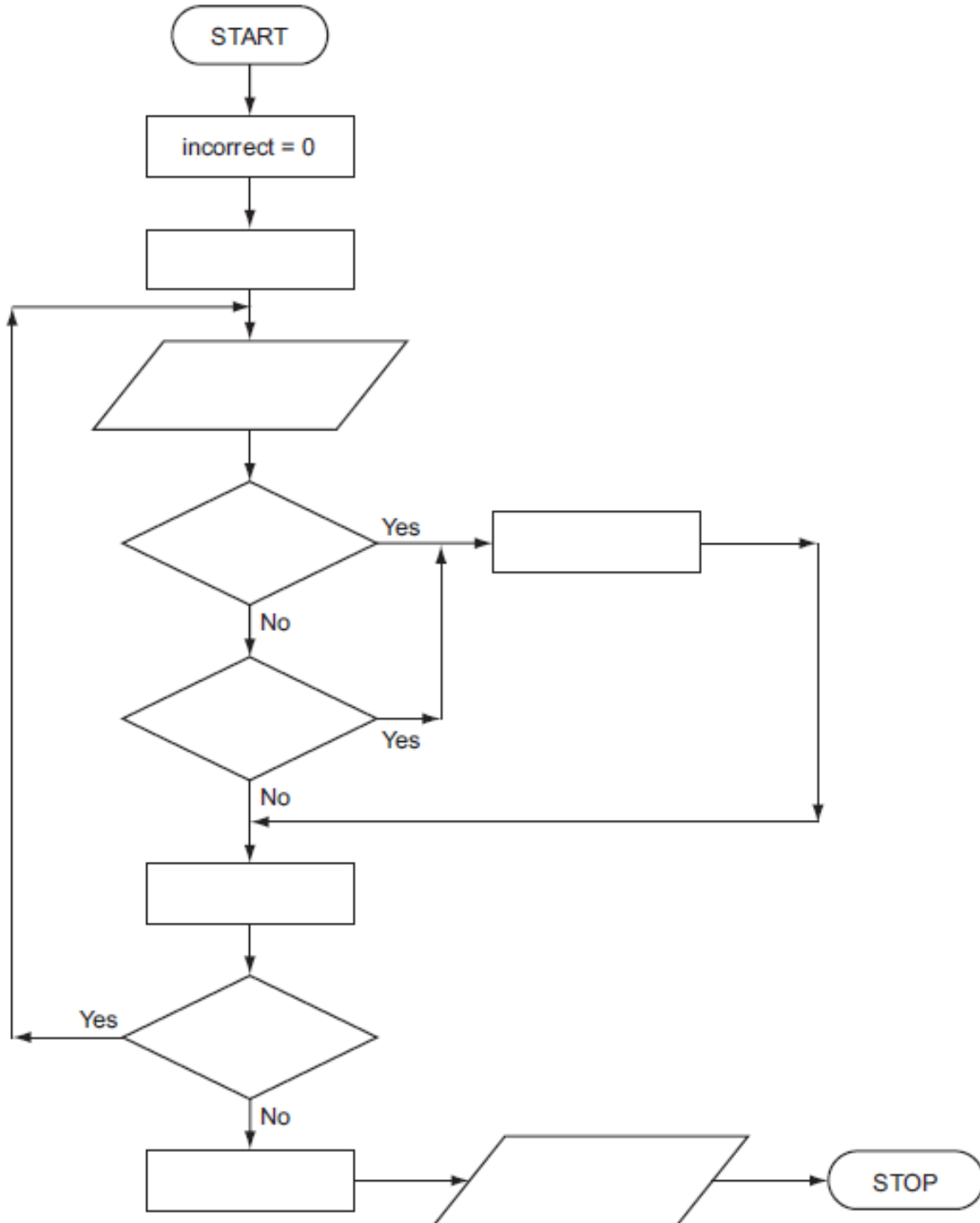
There is a flowchart on the opposite page. It has some statements missing.

Complete the flowchart. Use statement numbers only, chosen from the list below.

statement number	statement
1	Incorrect = Incorrect + 1
2	INPUT Code
3	is Number \leq 500 ?
4	is Code $<$ 1000 ?
5	is Code $>$ 9999 ?
6	Number = 1
7	Number = Number + 1
8	OUTPUT Percent
9	Percent = Incorrect / 5

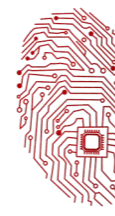


Topic: 2.1 Algorithm design and problem-solving



[4]



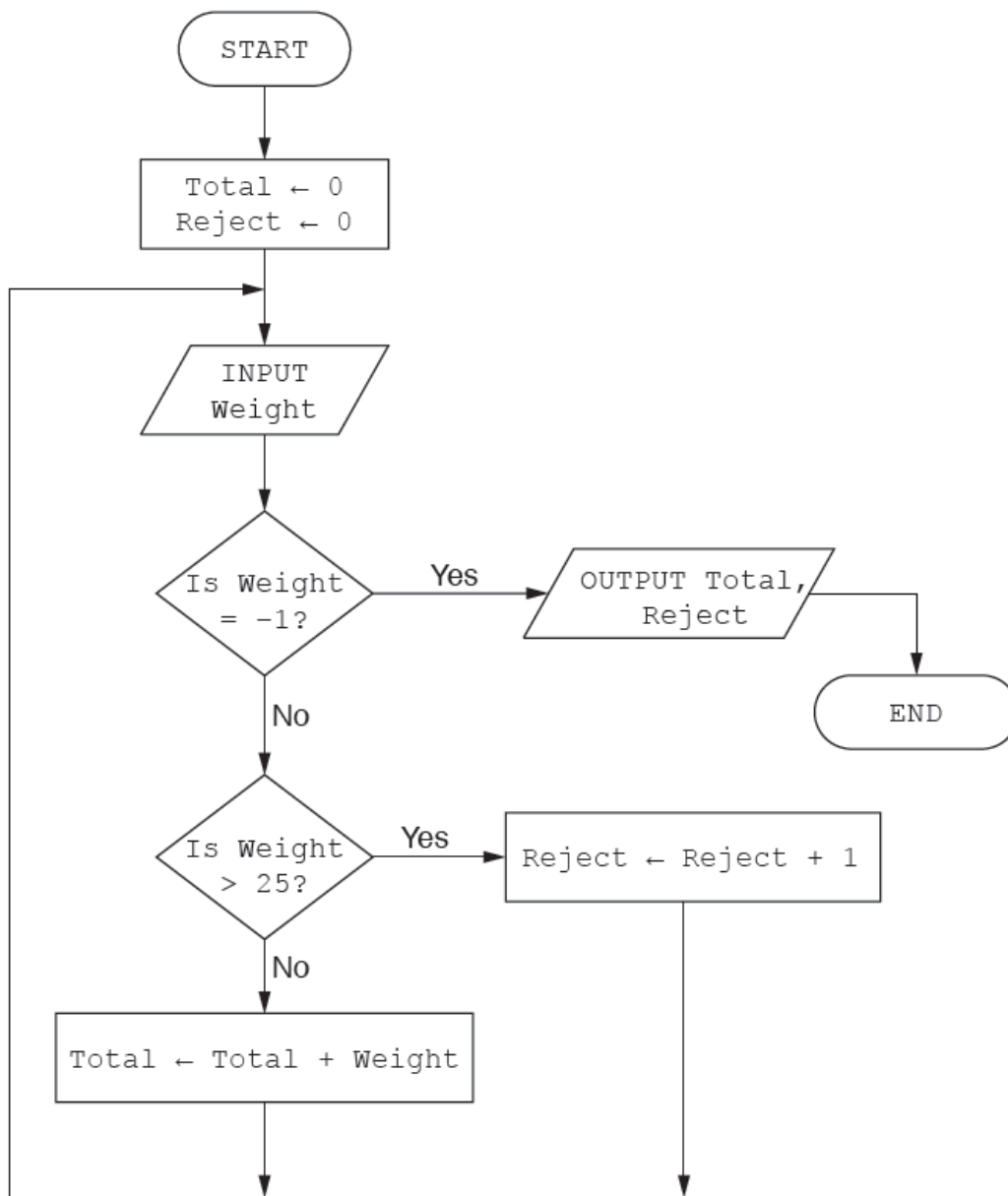


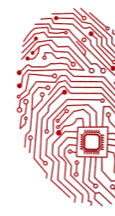
Topic: 2.1 Algorithm design and problem-solving

May/June 2015 P21 (2210)

- 3 The flowchart below inputs the weight of a number of parcels in kilograms. Parcels weighing more than 25 kilograms are rejected. A value of -1 stops the input.

The following information is output: the total weight of the parcels accepted and number of parcels rejected.

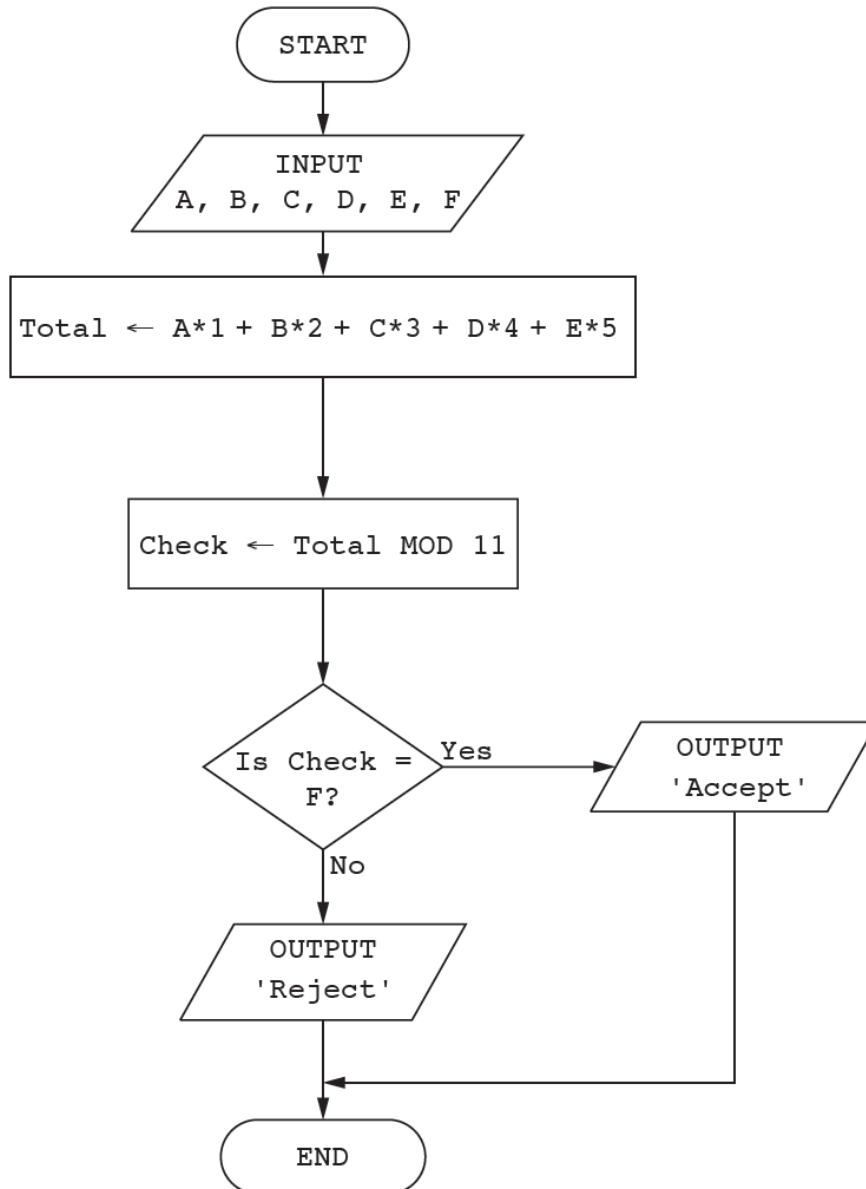




Topic: 2.1 Algorithm design and problem-solving

May/June 2015 P22 (2210)

- 3 (a) The flowchart below inputs six single digit numbers. The predefined function MOD gives the value of the remainder, for example, $Y \leftarrow 10 \text{ MOD } 3$ gives the value $Y = 1$





Topic: 2.1 Algorithm design and problem-solving

Complete a trace table for each of the two sets of input data.

Set 1 5, 2, 4, 3, 1, 5

Set 2 3, 2, 1, 0, 7, 3

Trace table set 1 5, 2, 4, 3, 1, 5

A	B	C	D	E	F	Total	Check	Output

Trace table set 2 3, 2, 1, 0, 7, 3

A	B	C	D	E	F	Total	Check	Output

[4]

(b) State the purpose of the flowchart in part (a).

.....
.....[1]

(c) Identify a problem with this flowchart and explain how to correct it.

Problem

.....

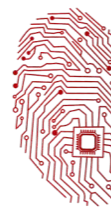
Solution

.....

.....

.....[3]





Topic: 2.1 Algorithm design and problem-solving

May/June 2016 P21 (2210)

Pre-release Material

The manager of a parcel delivery service needs a program to check the size and weight of parcels to determine which parcels can be accepted for delivery.

Write and test a program for the manager.

- Your program must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – Check the size and weight of a single parcel

Each parcel must obey the following rules to be accepted for delivery:

- each dimension must be no more than 80 cm
- the sum of the three dimensions must be no more than 200 cm
- the weight of the parcel must be between one and ten kilograms inclusive

Input and store the weight and dimensions for one parcel. All the dimensions and the weight must be validated on entry and an unsuitable parcel rejected.

Output if the parcel is accepted or rejected. If rejected, output **all** the reasons why the parcel was rejected.

TASK 2 – Check a customer's consignment of parcels

Input and store the number of parcels in the consignment. Calculate the number of parcels accepted and the total weight of the parcels accepted. For each parcel that was rejected, output **all** the reasons why that parcel was rejected.

Output the number of parcels accepted and the total weight of parcels accepted.
Output the number of parcels rejected.

TASK 3 – Calculate the price for a customer's consignment of parcels

Extend TASK 2 to also calculate the price for each parcel, using the following rules:

- 1 kg to 5 kg inclusive costs \$10
- Each 100 grams over 5 kg, up to 10 kg, costs an extra \$0.10

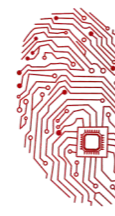
Your output should also include the price for each parcel accepted and the total price of the consignment.

1 (b) Write an algorithm to complete **Task 1**, using **either** pseudocode, programming statements or a flowchart. [5]

(c) Give **three** different data sets that could be used to check your validation rules for **Task 1**. Explain why you chose each data set. [6]

(d) Explain how your program calculates the price for a consignment (part of **Task 3**). You may





Topic: 2.1 Algorithm design and problem-solving

include programming statements as part of your explanation.

[4]

2 Read this section of program code that inputs 10 positive numbers and then outputs the smallest number input.

```

1 Small = 1000
2 Counter = 0
3 REPEAT
4 INPUT Num
5 IF Num < Small THEN Small = Num
6 Counter = Counter + 1
7 UNTIL Counter = 10
8 PRINT Small
    
```

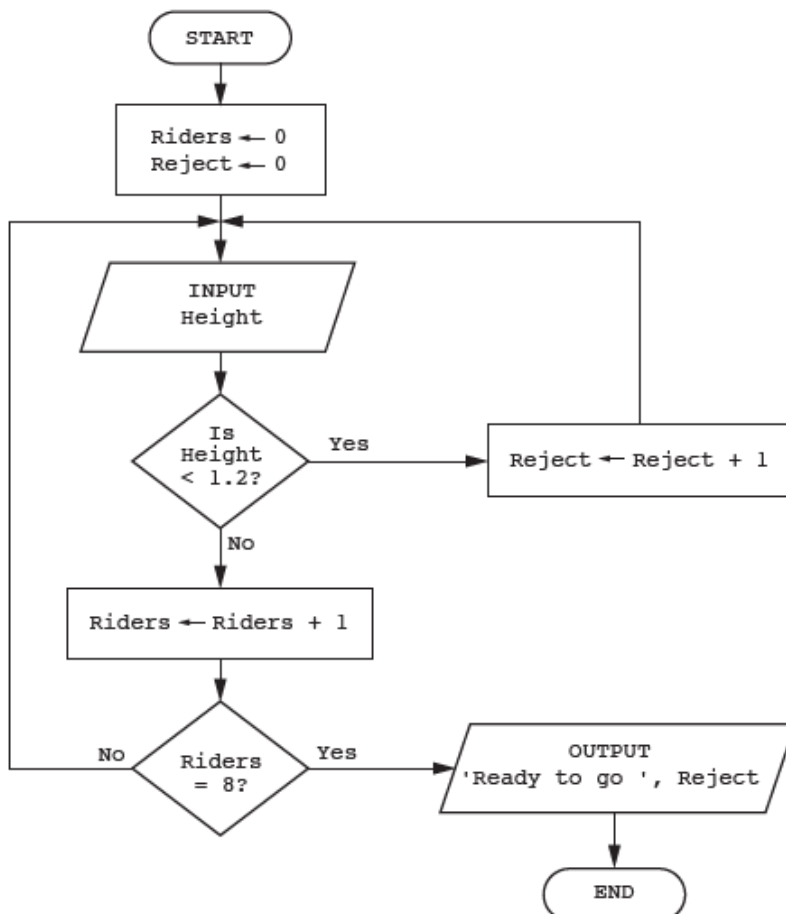
(i) Identify **three** changes you would need to make to find the largest number input instead of the smallest number.

[3]

(ii) Rewrite the program code with your changes.

[3]

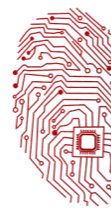
4 The flowchart below inputs the height of children who want to ride on a rollercoaster. Children under 1.2 metres are rejected. The ride starts when eight children have been accepted.



Complete the trace table for the input data:

1.4, 1.3, 1.1, 1.3, 1.0, 1.5, 1.2, 1.3, 1.4, 1.3, 0.9, 1.5, 1.6, 1.0





Topic: 2.1 Algorithm design and problem-solving

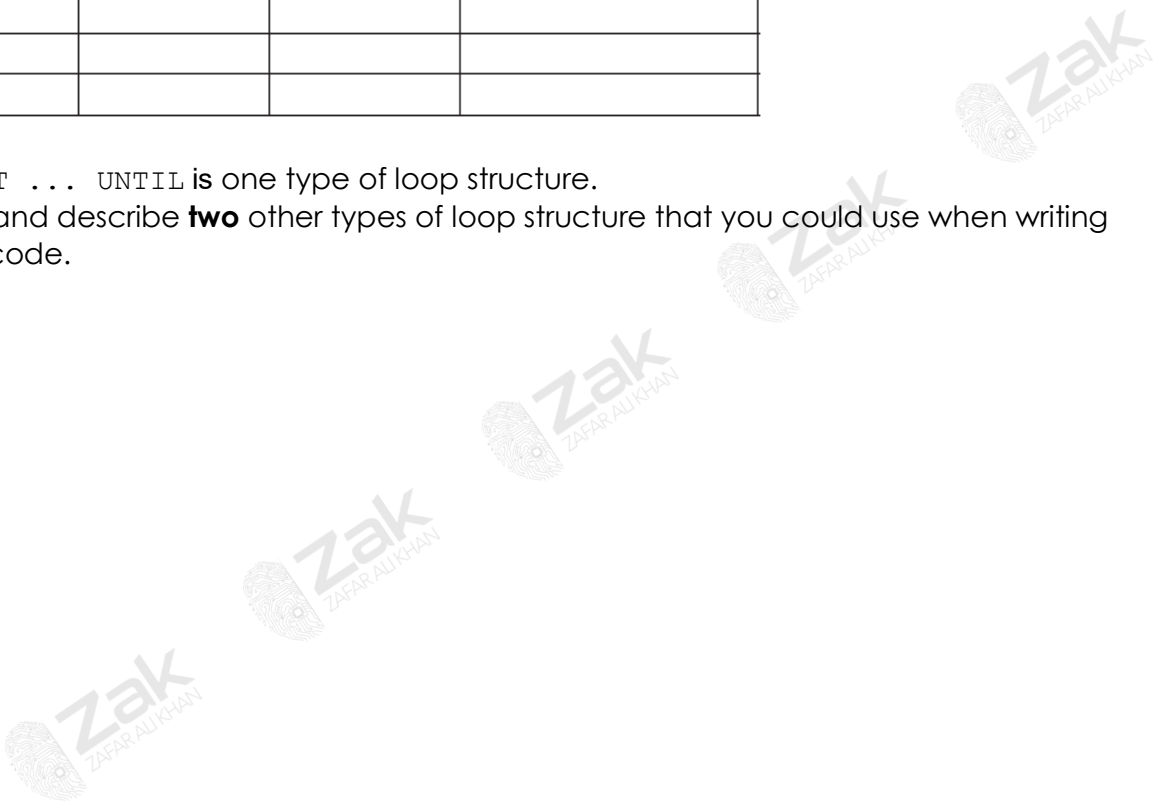
Riders	Reject	Height	OUTPUT

[4]

5 REPEAT . . . UNTIL is one type of loop structure.

Identify and describe **two** other types of loop structure that you could use when writing pseudocode.

[4]





Topic: 2.1 Algorithm design and problem-solving

May/June 2016 P22 (2210)

Pre-release Material

The manager of a building materials delivery service needs a program to check the contents and weight of sacks to ensure that correct orders are made up for delivery. A price for the order will be calculated.

Write and test a program for the manager.

- Your program must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – Check the contents and weight of a single sack

Each sack must obey the following rules to be accepted:

- contain cement, gravel or sand, with a letter on the side for easy identification
 - C - cement
 - G - gravel
 - S - sand
- sand or gravel must weigh over 49.9 and under 50.1 kilograms
- cement must weigh over 24.9 and under 25.1 kilograms

Input and store the weight and contents for one sack. The contents must be checked and an incorrect sack rejected. The weight must be validated on entry and an overweight or underweight sack rejected.

Output the contents and weight of an accepted sack. If a sack is rejected, output the reason(s).

TASK 2 – Check a customer's order for delivery

Input and store the number of sacks of each type required for the order. Use TASK 1 to check the contents and weight of each sack. Ensure that the delivery contains the correct number and type of sacks for the order.

Output the total weight of the order.

Output the number of sacks rejected from the order.

TASK 3 – Calculate the price for a customer's order

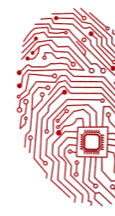
Extend TASK 2 to calculate a price for an order. Prices for the sacks are as follows:

- regular price for each sack
 - cement, \$3
 - gravel, \$2
 - sand, \$2
- discount price for a special pack containing 1 sack of cement, 2 sacks of sand and 2 sacks of gravel, \$10

Calculate and output the regular price for the order. Check how many special packs are in the order. If a discount price applies then output the new price for the order and the amount saved.

1 (b) Write an algorithm to complete **Task 2**, using **either** pseudocode, programming statements or a flowchart. You can assume that the weight and contents have already been checked and





Topic: 2.1 Algorithm design and problem-solving

accepted in Task 1. You do not need to output the number of sacks rejected.

[6]

(c) (i) Give **two** different data values that could be used to check your validation rules for sand in **Task 1**. Explain why you chose each value.

[2]

(ii) Give **two** different data values that could be used to check your validation rules for cement in **Task 1**. Explain why you chose each value.

[2]

(d) Explain how your program calculates the price for an order (**Task 3**). You may include programming statements as part of your explanation.

[5]

2 Read this section of program code that inputs 10 positive numbers and then outputs the total.

```
1 Total = 0
2 Counter = 0
3 REPEAT
4 INPUT Num
5 Total = Total + Num
6 PRINT Total
7 Counter = Counter + 1
8 UNTIL Counter = 10
```

This code works, but it is inefficient.

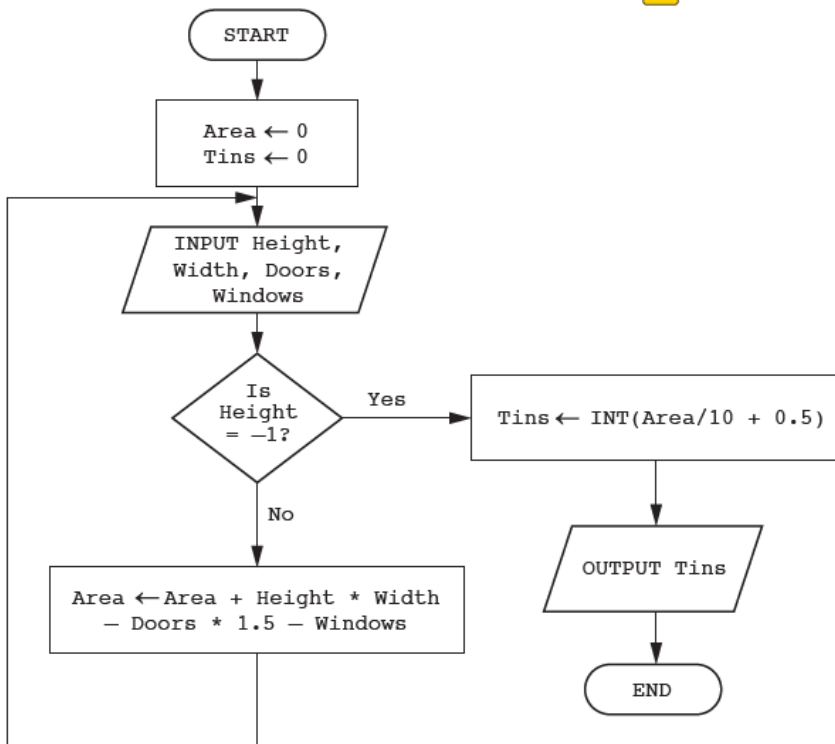
(i) Suggest **three** improvements that could be made.

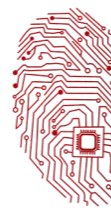
[3]

(ii) Rewrite the program code with your improvements.

[3]

3 The flowchart below calculates the number of tins of paint required to paint walls. The flowchart inputs the height and width of a wall in metres, the number of doors and the number of windows. A value of -1 for the height stops the input.





Topic: 2.1 Algorithm design and problem-solving

Complete the trace table for the input data:
3, 5, 1, 0, 3, 7, 0, 0, 3, 5, 0, 3, 3, 7, 1, 1, -1, 0, 0, 0

Area	Tins	Height	Width	Doors	Windows

[4]





Topic: 2.1 Algorithm design and problem-solving

Oct/Nov 2015 P23 (2210)

Pre-release Material

Write and test a program to complete the **three** tasks.

The temperature in an apartment needs to be kept between 22°C and 24°C. This is done by the use of an automatically controlled air-conditioning system, which monitors the temperature every five minutes. The temperature of the apartment is recorded, to one decimal place, in degrees Celsius. The cooling is activated when the temperature reaches 24.5°C and the heating is activated when the temperature reaches 21.5°C.

TASK 1

To simulate the monitoring required, write a routine that allows entry of the apartment's temperature in degrees Celsius. The routine checks whether the temperature is within the acceptable range, too high or too low and outputs a suitable message in each case.

TASK 2

Write another routine that stores, in an array, the temperatures taken over a period of five hours. This routine calculates the difference between the highest temperature and the lowest temperature. Then it outputs the highest temperature, the lowest temperature, and the difference between these temperatures.

TASK 3

Write a routine to find out how often the temperature was out of the acceptable range during the five hours and whether the temperature was too high or too low; output a suitable message showing a summary of the problem.

Your program must include appropriate prompts for the entry of data. Error messages and other outputs need to be set out clearly and understandably. All variables, constants and other identifiers must have meaningful names. Each task must be fully tested.

1 (a) All variables, constants and other identifiers should have meaningful names.

(i) When you performed the tasks, you used variables.

Write suitable declarations for **two** of these.

State what you used each one for.

[4]

(ii) When you performed the tasks, you may have used constants.

Write suitable declarations for **two** of these.

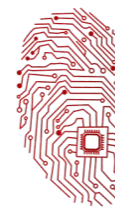
State what you used each one for.

[4]

(b) Write an algorithm to complete **Task 2**, using **either** pseudocode, programming statements **or** a flowchart. You should assume that the temperatures taken over the five hours are already stored in an array.

[5]





Topic: 2.1 Algorithm design and problem-solving

(c) (i) Explain how you completed **Task 3**. You should assume that Task 2 has been completed. You can include pseudocode or programming statements as part of your explanation. [6]

(ii) Comment on the efficiency of your design for **Task 3**. [1]

2 Read this section of program code that should input 50 numbers and then output the average of the positive numbers only.

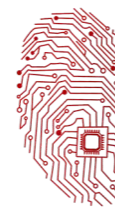
```
1  Total = 0
2  PosCount = 0
3  FOR Counter = 1 TO 50
4      INPUT Num
5      IF Num < 0 THEN Total = Total + Num
6      IF Num > 0 THEN Counter = Counter + 1
7      Average = Total/PosCount
8  NEXT Counter
9  PRINT Num
```

There are **four** errors in this code.

Locate these errors and suggest code corrections to remove each error.

[4]





Topic: 2.1 Algorithm design and problem-solving

- 3 (a) This pseudocode inputs an integer. The predefined function DIV gives the value of the division, e.g. $Y \leftarrow 10 \text{ DIV } 3$ gives the value $Y = 3$. The predefined function MOD gives the value of the remainder, e.g. $Y \leftarrow 10 \text{ MOD } 3$ gives the value $Y = 1$.

```
INPUT X
WHILE X > 15
  DO
    T1 ← X DIV 16
    T2 ← X MOD 16
    CASE T2 OF
      10:OUTPUT A
      11:OUTPUT B
      12:OUTPUT C
      13:OUTPUT D
      14:OUTPUT E
      15:OUTPUT F
    OTHERWISE OUTPUT T2
  ENDCASE
  X ← T1
ENDWHILE
CASE X OF
  10:OUTPUT A
  11:OUTPUT B
  12:OUTPUT C
  13:OUTPUT D
  14:OUTPUT E
  15:OUTPUT F
  OTHERWISE OUTPUT X
ENDCASE
```

Complete a trace table for each of the two input values 37 and 191.

Trace table for input value 37

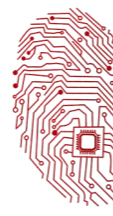
X	T1	T2	OUTPUT

Trace table for input value 191

X	T1	T2	OUTPUT

[4]





Topic: 2.1 Algorithm design and problem-solving

(b) State the purpose of the pseudocode in **part (a)**. [2]

4 A routine checks the age and height of children who are allowed to enter a play area. The children

must be less than 5 years of age and under 1 metre in height.

(a) The first set of test data used is age 3 and height 0.82 metres.

State what type of test data this is.

Give a reason for using this test data.

[2]

(b) Provide **two** additional sets of test data. For each, give

- the type of each set of test data
- the reason why it is used

Each type of test data and reason for use must be different.

[6]

5 A motor boat hire company decides to set up a database to keep information about boats that are

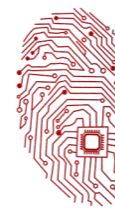
available for hire. The database table, BOAT, will contain the following fields:

Boat Name; Model; Engine Power (in hp); Number of Seats; Life Raft (whether there is a life raft kept on the boat); Day Price (price for a day's hire).

(a) Give the data type you would choose for each field.

[3]





Topic: 2.1 Algorithm design and problem-solving

Oct/Nov 2016 P22 (2210)

Pre-release Material

The manager of a supermarket needs a program to record donations to charity. Each customer has the choice of three charities to donate to, and 1% of their shopping bill will be donated to the chosen charity.

Write and test a program for the manager.

- Your program must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – Set up the donation system

Set up a routine that allows:

- the names of three charities to be input and stored
- the charity names to be displayed with a number (1, 2 or 3) beside each name
- a choice of 1, 2 or 3 to be entered to choose the charity, all other entries rejected
- the value of a customer's shopping bill to be entered
- the donation to be calculated
- three totals to be set to zero ready to total each charity donation

TASK 2 – Record and total each donation

For a customer's shopping bill:

- input a charity choice of 1, 2 or 3
- input the value of a customer's shopping bill
- calculate the donation
- add the donation to the appropriate total

Output the name of the charity and the amount donated.

TASK 3 – Show the totals so far

Extend TASK 2 to accept:

- donations from more customers
- a charity choice of -1 to show the totals so far

Display the charities' names and the totals in descending order of totals.

Calculate a grand total of all three totals.

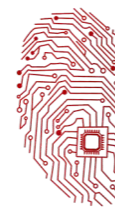
Output 'GRAND TOTAL DONATED TO CHARITY' and the amount of the grand total.

1 (a) All variables, constants and other identifiers should have meaningful names.

(i) For **three** of the variables that you have used in **Task 1**, state the name, type and its use. **[3]**

(ii) Name and describe the data structure(s) that you have used to store the donation totals for each charity. Explain why you chose your data structure(s). **[3]**





Topic: 2.1 Algorithm design and problem-solving

2 Read this section of program code that inputs positive numbers, discards any negative numbers and then outputs the average. An input of zero ends the process.

```
1 Total = 0
2 Counter = 100
3 REPEAT
4   REPEAT
5     INPUT Num
6     UNTIL Num < 0
7     Total = Total + 1
8     Counter = Counter + Num
9   UNTIL Num = 0
10 Average = Total / (Counter - 1)
11 Print Average
```

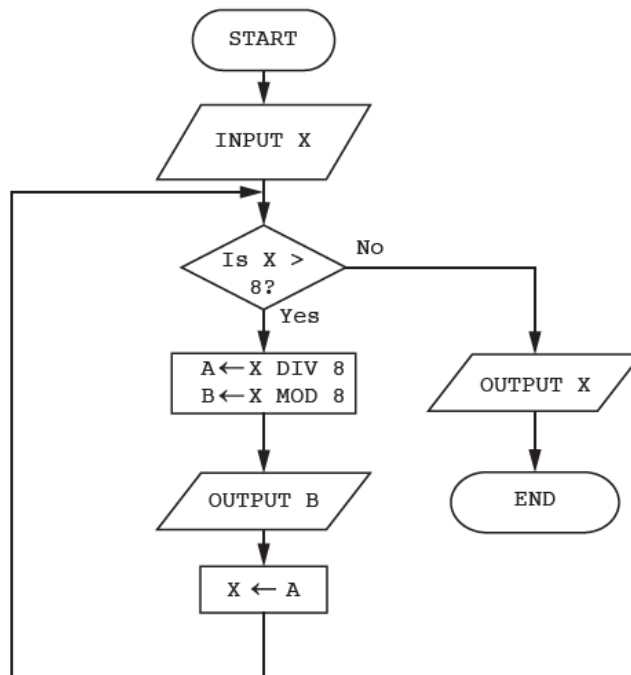
There are four errors in this code.

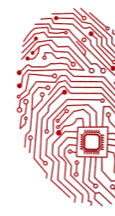
Locate these errors and suggest a correction to remove each error.

[8]

3 The flowchart below inputs an integer. The predefined function DIV gives the value of the division,

for example $Z \leftarrow 11 \text{ DIV } 3$ gives the value $Z = 3$. The predefined function MOD gives the value of the remainder, for example $Z \leftarrow 11 \text{ MOD } 3$ gives the value $Z = 2$.





Topic: 2.1 Algorithm design and problem-solving

Complete a trace table for each of the two input values **33** and **75**.

Trace table for input value **33**

X	A	B	OUTPUT

Trace table for input value **75**

X	A	B	OUTPUT

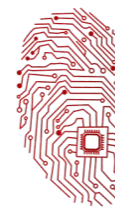
[4]

4 IF ... THEN ... ELSE ... ENDIF and CASE ... OF ... OTHERWISE ... ENDCASE are two different conditional statements that you can use when writing pseudocode.

Explain, using examples, why you would choose to use each conditional statement.

[6]





Topic: 2.1 Algorithm design and problem-solving

Oct/Nov 2016 P23 (2210)

Pre-release Material

The headteacher of a school needs a program to record and count the votes for a class captain. Each student in the class will be allowed one vote. There can be up to 30 students in a class.

Write and test a program for the headteacher.

- Your program must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – Set up the voting

Each class can choose from up to four different students as candidates for their class captain. Set up a routine that allows:

- between two and four different candidate names to be input and stored
- the candidate names to be displayed with a number (1, 2, 3 or 4) beside each name
- a choice of 1, 2, 3 or 4 to be entered to record a vote; all other entries are rejected
- up to four totals set to zero ready to record the votes
- a maximum of 30 votes to be cast

TASK 2 – Record and count each vote

Input a number 1, 2, 3 or 4; add 1 to the appropriate total.

Output the name of the candidate voted for or output 'invalid vote' if a vote is rejected.

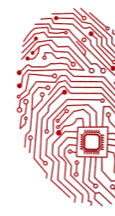
TASK 3 – Show the result

When all the votes have been cast, display the candidates' names with their totals in descending order of totals. If there is a clear winner, display the candidate's name with the words 'NEW CLASS CAPTAIN' beside it; otherwise display 'NO OVERALL WINNER'.

1 (a) All variables, constants and other identifiers should have meaningful names. For **four** of the variables, constants or arrays that you used in **Task 1**, state the name, data structure, data type and its use.

[8]





Topic: 2.1 Algorithm design and problem-solving

2 Read this section of program code that:

- inputs 10 numbers
- checks whether each number is within a specified range
- totals the numbers within the range and outside the range

```
1 InRange = 0
2 OutRange = 1000
3 FOR Count = 1 TO 10
4     INPUT Num
5     IF Num > 10 AND Num < 20 THEN InRange = InRange + 1
6     ELSE OutRange = OutRange - 1
7     Count = Count + 1
8 NEXT X
9 PRINT InRange, OutRange
```

(a) There are four errors in this code.

Locate these errors and suggest a correction to remove each error.

[4]

(b) Decide, with reasons, whether the numbers 10 and 20 are within or outside the range.

Number	Within range (✓)	Outside range (✓)	Reason
10		
20		

[4]

3 The flowchart below inputs the price of an item under \$10. The change from a \$10 note is output.

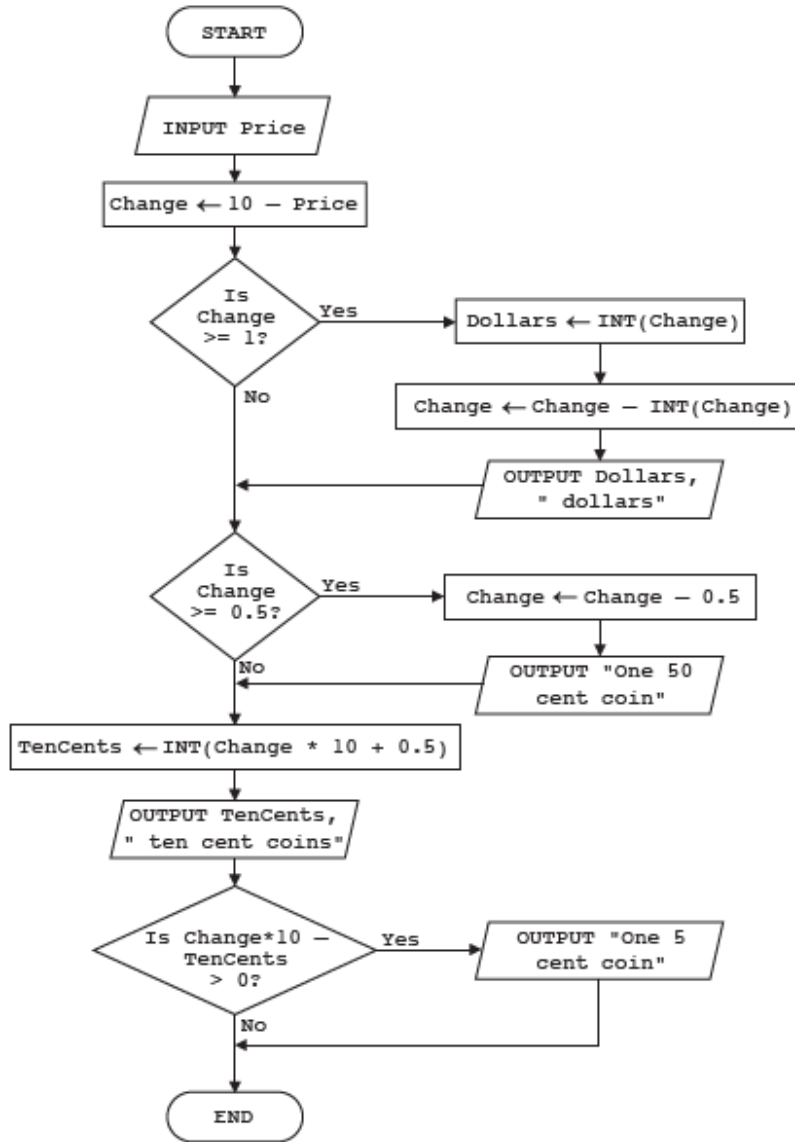
Any amount less than 5 cents is rounded up to 5 cents.

The predefined function INT rounds a number down to the nearest whole number; for example $Z \leftarrow \text{INT}(5.7)$ gives the value $Z = 5$



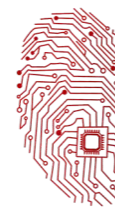


Topic: 2.1 Algorithm design and problem-solving



Complete the trace table for the input data: 6.29





Topic: 2.1 Algorithm design and problem-solving

Price	Change	Dollars	TenCents	OUTPUT

[5]

4 Four validation checks and four descriptions are shown below. Draw a line to link each validation check to the correct description.

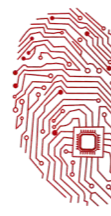
Validation check	Description
<div style="border: 1px solid black; padding: 5px; width: fit-content;">Presence check</div>	<div style="border: 1px solid black; padding: 5px; width: fit-content;">Numbers between two given values are accepted</div>
<div style="border: 1px solid black; padding: 5px; width: fit-content;">Range check</div>	<div style="border: 1px solid black; padding: 5px; width: fit-content;">Data is of a particular specified type</div>
<div style="border: 1px solid black; padding: 5px; width: fit-content;">Type check</div>	<div style="border: 1px solid black; padding: 5px; width: fit-content;">Data contains an exact number of characters</div>
<div style="border: 1px solid black; padding: 5px; width: fit-content;">Length check</div>	<div style="border: 1px solid black; padding: 5px; width: fit-content;">Ensures that some data have been entered</div>

[3]

5 REPEAT ... UNTIL and WHILE ... DO ... ENDWHILE are two different loop structures you can use when writing pseudocode. Explain, using examples, why you would choose to use each type of loop.

[6]





Topic: 2.1 Algorithm design and problem-solving

Oct/Nov 2017 P22 (2210)

Pre-release material

The owner of a river boat hire company wants to calculate the daily profits from hiring out 10 rowing boats on the river. Boats are numbered 1 to 10. Boats can be hired for use between 10:00 and 17:00 every day.

Write and test a program for the owner.

- Your program must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – calculate the money taken in a day for one boat.

The cost of hiring a boat is \$20 for one hour or \$12 for half an hour. When a boat is hired the payment is added to the money taken for the day. The running total of hours hired that day is updated and the time when the boat must be returned is stored. At the end of the day the money taken and the total hours hired is output.

No boat can be hired before 10:00 or returned after 17:00.

TASK 2 – find the next boat available.

Extend **TASK 1** to work for all 10 rowing boats. Use the data stored for each boat to find out how many boats are available for hire at the current time. If no boats are available show the earliest time that a boat will be available for hire.

TASK 3 – calculate the money taken for all the boats at the end of the day.

At the end of the day use the data stored for each boat to calculate the total amount of money taken and the total number of hours boats were hired that day. Find out how many boats were not used that day and which boat was used the most. Provide a report for the owner to show this information.

1 (b) Give **two** different validation checks you could have used for data entry in **Task 1**. For each check explain why it could be used and provide a set of data for testing. **[6]**

(c) Write an algorithm to complete **Task 3**, using **either** pseudocode, programming statements **or** a flowchart. You may assume Task 2 has been completed. **[5]**

(d) Explain how your program finds out how many boats are available for hire (**Task 2**). Any programming statements used must be fully explained. **[4]**

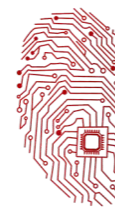
2 Write an algorithm using **either** pseudocode **or** a flowchart, to:

- input a positive integer
- use this value to set up how many other numbers are to be input
- input these numbers
- calculate and output the total and the average of these numbers. **[6]**

4 IF ... THEN ... ELSE ... ENDIF is one type of conditional statement used when writing pseudocode.

Identify and describe **another** type of conditional statement that you could use when writing pseudocode. Give a reason why you would use this type of conditional statement. **[4]**





Topic: 2.1 Algorithm design and problem-solving

(b) The size of the batch has increased to 50 sacks. It has been decided to only reject sacks that are underweight.

State the changes that need to be made to the flowchart.

[2]

Oct/Nov 2017 P23 (2210)

Pre-release material

A small airfield operates a flying club where people can take a short flight to see if they would like flying lessons. The owner of the airfield has asked you to write a program to organise the flight bookings. The airfield operates three different planes and offers either a 30 minute or a 60 minute flight.

The following table shows the tariff:

Length of Flight	2 Seater Plane	4 Seater Plane	Historic Plane
30 minutes	\$100	\$120	\$300
60 minutes	\$150	\$200	\$500

After each flight, 30 minutes must be allowed for refuelling and safety checks before the next flight can take off. All planes offer both 30 minute and 60 minute flights, but, for the purpose of this activity, they will not be mixed on a given day, e.g. the 2 seater will offer 30 minute flights ONLY on one day and 60 minute flights ONLY on another day.

Write and test a program for the owner of the airfield.

- Your program must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these three tasks. Each task must be fully tested.

TASK 1 – Work out the maximum income.

Assume that the flights take place between 08:00 and 18:00. Write a program that will work out the maximum income that can be generated by each plane in a day for each type of flight. The program should allow you to:

- input the type of plane
- input the length of flight
- calculate the maximum number of flights in a day
- output the total possible income per day for the choice of plane and length of flight

TASK 2 – Record bookings.

Write a program to store bookings for each plane and to allow you to find which planes are available at a given time slot during the day. The program should calculate the actual number of flights taken by each plane in that day.

TASK 3 – Work out income.

Modify TASK 2 so that it will calculate the total amount of money taken in a day for each plane, as well as the overall daily total for all three planes, and output the results.





Topic: 2.1 Algorithm design and problem-solving

1 (b) Write an algorithm to complete **Task 1**, using **either** pseudocode, programming statements or a flowchart. **[5]**

(c) Describe how you could validate and test the inputs for **Task 1**. **[4]**

(d) Explain how your program checks and displays whether any of the planes are available at a given time of the day (**Task 2**). Any programming statements used must be fully explained. **[4]**

2 This section of program code asks for 80 numbers between 100 and 1000 to be entered. It checks that the numbers are in the correct range, and stores them in an array. It counts how many of the numbers are larger than 500 and then outputs the result when the program is finished.

```
1 Count = 0
2 FOR Index = 1 TO 80
3     INPUT 'Enter a number between 100 and 1000', Number
4     WHILE Number = 99 AND Number = 1001
5         INPUT 'This is incorrect, please try again', Number
6     ENDWHILE
7     Num[80] = Number
8     IF Number > 500 THEN Count = Count + 1
9 UNTIL Index = 80
10 PRINT Index
11 PRINT ' numbers were larger than 500'
```

There are **four** lines of code that contain errors.

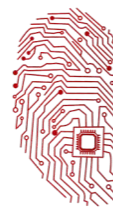
State the line number for each error and write the correct code for that line. **[4]**

3 (a) Explain the difference between a validation check and a verification check. **[2]**

(b) Describe, using an example, how data could be verified on data entry. **[2]**

(c) Explain what is meant by the term library routine. **[2]**





Topic: 2.1 Algorithm design and problem-solving

May/June 2018 P23 (2210)

Pre-release material

A farmer records the milk production of a herd of cows. Every cow has a unique 3-digit identity code. Each cow can be milked twice a day, seven days a week. The volume of milk from each cow is recorded in litres correct to one decimal place (yield) every time the cow is milked. The size of the herd is fixed. At the end of the week the total and the average yield for each cow for that week is calculated.

The farmer identifies the cow that has produced the most milk that week. The farmer also identifies any cows that have produced less than 12 litres of milk on four or more days that week.

A program is required to record the yield for each cow every time it is milked, calculate the total weekly volume of milk for the herd and the average yield per cow in a week. The program must also identify the cow with the best yield that week and identify any cows with a yield of less than 12 litres of milk for four or more days that week.

Write and test a program or programs for the farmer.

- Your program or programs must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – Record the yield.

Write a program for TASK 1 to record the milk yields for a week. The program records and stores the identity code number and the yield every time a cow is milked.

TASK 2 – Calculate the statistics.

Using your recorded data from TASK 1, calculate and display the total weekly volume of milk for the herd to the nearest whole litre. Calculate and display the average yield per cow in a week to the nearest whole litre.

TASK 3 – Identify the most productive cow and cows that are producing a low volume of milk.

Extend TASK 2 to identify and display the identity code number and weekly yield of the cow that has produced the most milk. Also identify and display the identity code numbers of any cows with a yield of less than 12 litres of milk for four days or more in the week.

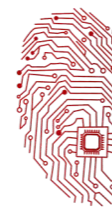
1 (b) Explain how your program for **Task 1** ensures that each 3-digit identity code is unique. [2]

(c) Write an algorithm for **Task 2**, using **either** pseudocode, programming statements **or** a flowchart.

Assume that **Task 1** has been completed. [5]

(d) (i) Explain how your program for **Task 3** finds the cows with a daily yield of less than 12 litres of milk for four days or more in the week. Any programming statements used in your answer must be fully explained. [5]





Topic: 2.1 Algorithm design and problem-solving

(ii) Explain how you would extend your program for **Task 3** to **store** the identity code number(s) of those cows with a yield of less than 12 litres of milk for four days or more in the week. [2]

2 (a) Draw a flowchart for an algorithm to input numbers. Reject any numbers that are negative and count how many numbers are positive. When the number zero is input, the process ends and the count of positive numbers is output.

(b) Explain the changes you will make to your algorithm to also count the negative numbers. [2]

3 This pseudocode algorithm inputs two non-zero numbers and a sign, and then performs the calculation shown by the sign. An input of zero for the first number terminates the process.

```
INPUT Number1, Number2, Sign
WHILE Number1 <> 0
    IF Sign = '+' THEN Answer Number1 + Number2 ENDIF
    IF Sign = '-' THEN Answer Number1 - Number2 ENDIF
    IF Sign = '*' THEN Answer Number1 * Number2 ENDIF
    IF Sign = '/' THEN Answer Number1 / Number2 ENDIF
    IF Sign <> '/' AND Sign <> '*' AND Sign <> '-' AND Sign <> '+'
        THEN Answer 0
    ENDF
    IF Answer <> 0 THEN OUTPUT Answer ENDF
    INPUT Number1, Number2, Sign
ENDWHILE
```

(a) Complete the trace table for the input data:

5, 7, +, 6, 2, -, 4, 3, *, 7, 8, ?, 0, 0, /

Number1	Number2	Sign	Answer	OUTPUT

(b) Show how you could improve the algorithm written in pseudocode by writing an alternative type of conditional statement in pseudocode. [3]

4 A programmer has written a routine to store the name, email address and password of a contributor to a website's discussion group.

(a) The programmer has chosen to verify the name, email address and password.

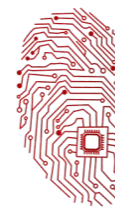
Explain why verification was chosen and describe how the programmer would verify this data. [4]

(b) The programmer has also decided to validate the email address and the password.

Describe validation checks that could be used. [2]

5 A program checks that the weight of a basket of fruit is over 1.00 kilograms and under 1.10 kilograms. Weights are recorded to an accuracy of two decimal places and any weight not in this form has already been rejected.





Topic: 2.1 Algorithm design and problem-solving

Give **three** weights as test data and for each weight state a reason for choosing it. All your reasons must be different. **[3]**

May/June 2018 P21 (2210)

Pre-release material

A computer shop will build a computer from components to meet a customer's requirements. For each request for a computer to be built, an estimate of the cost is produced. The component stock level is checked; if all the components are in stock, a firm order to build the computer can be placed. A program is required to work out the cost of the computer, update the stock levels and provide a daily summary of orders for the shop owner.

Write and test a program or programs for the computer shop owner.

- Your program or programs must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – Produce an estimate.

Write a program for TASK 1 to calculate the cost of building a computer using these components.

Component	Choices	Prices in \$
Processor	p3 / p5 / p7	100 / 120 / 200
RAM	16GB / 32GB	75 / 150
Storage	1TB / 2TB	50 / 100
Screen	19" / 23"	65 / 120
Case	Mini Tower / Midi Tower	40 / 70
USB ports	2 ports / 4 ports	10 / 20

The customer makes a choice for each component and an estimate is produced. The estimate must show a unique estimate number, the components chosen and the price of each component. The estimate must also show the total cost of the computer, which is calculated as the sum of the cost of the components chosen plus 20%.

TASK 2 – Place an order.

Using your estimate from TASK 1, check if the components required are in stock. If all the components are in stock then update the stock levels. Add the unique estimate number to the list of order numbers. Add the customer's details and today's date to the estimate details to finalise the order. Print two copies of the order, one for the customer and one for the shop.

TASK 3 – Summarise the day's orders.

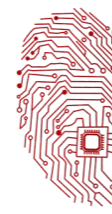
Extend TASK 2 to provide an end of day summary showing the number of orders made, the total number of each component sold and the value of the orders.

(b) Explain how your program for **Task 1** produces a unique estimate number. **[2]**

(c) Write an algorithm for part of **Task 2** to check that the chosen **processor** and chosen **RAM** are in stock, using **either** pseudocode, programming statements **or** a flowchart. Assume that **Task 1** has been completed. Do **not** check the other components or produce the order. **[5]**

(d) Explain how your program completes **Task 3**. Any programming statements used in your answer must be fully explained. **[5]**





Topic: 2.1 Algorithm design and problem-solving

2 (a) Write an algorithm to input 1000 numbers. Count how many numbers are positive and how many numbers are zero. Then output the results. Use **either** pseudocode **or** a flowchart. **[6]**

(b) Give one change you could make to your algorithm to ensure initial testing is more manageable. **[1]**

3 The global trade item number (GTIN-8) barcode has seven digits and a check digit. This pseudocode algorithm inputs seven digits and calculates the eighth digit, then outputs the GTIN-8.

DIV (X, Y), finds the number of divides in division for example **DIV (23, 10)** is 2.

MOD (X, Y), finds the remainder in division for example **MOD (23, 10)** is 3.

```
FOR Count <- 1 TO 7
    INPUT Number
    Digit(Count) <- Number
NEXT
Sum <- (Digit(1)+Digit(3)+Digit(5)+Digit(7))*3+Digit(2)+Digit(4)+Digit(6)
IF MOD(Sum,10) <> 0
    THEN Digit(8) <- DIV(Sum,10)*10 + 10 - Sum
    ELSE Digit(8) <- 0
ENDIF
OUTPUT "GTIN-8"
FOR Count <- 1 TO 8
    OUTPUT Digit(Count)
NEXT
```

(a) Complete the trace table for the input data: 5, 7, 0, 1, 2, 3, 4

Digit(1)	Digit(2)	Digit(3)	Digit(4)	Digit(5)	Digit(6)	Digit(7)	Digit(8)	Sum	OUTPUT

Complete the trace table for the input data: 4, 3, 1, 0, 2, 3, 1

Digit(1)	Digit(2)	Digit(3)	Digit(4)	Digit(5)	Digit(6)	Digit(7)	Digit(8)	Sum	OUTPUT

[5]

(b) Explain how you would change the algorithm to input eight digits (seven digits and the check digit) and output if the check digit entered is correct or not. **[3]**

4 A programmer has written a routine to check that prices are below \$10.00. These values are used as test data.

10.00 9.99 ten

Explain why each value was chosen. **[3]**

