 FOR OFFICIAL USE	
National Qualifications	Mark

CS(H)22B

Computing Science

Duration	– 2 hours											
Fill in the below.	ese boxes aı	nd read w	hat is printed	1								
Full name	of centre				Tow	n						
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Day	Month	Year		Scotti	sh can	didate	numb	er				
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Total marks - 80

SECTION 1 - 55 marks

Attempt ALL questions.

Attempt questions from either SECTION 2 or SECTION 3 only.

SECTION 1 - Database Design and Development Page 18

SECTION 2 - Web Design and Development Page 27

Write your answers clearly in the spaces provided in this booklet. Additional space for answers is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting.

Use blue or black ink.

Before leaving the examination room you must give this booklet to the invigilator. If you do not, you may lose all marks for this paper.



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SECTION 1 - 55 MARKS

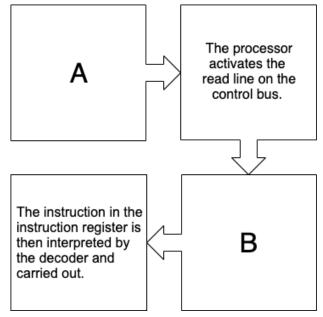
Attempt ALL questions

ine ine ine ine ine i	36 END IF
	Name the standard algorithm shown above.
(b)	Explain the purpose of Line 30.
ttac	minal gang have attacked the systems of a security company. During the k, the gang obtained the security plans for a bank which they plan to steal
tac om ent	k, the gang obtained the security plans for a bank which they plan to steal
ittac rom dent	k, the gang obtained the security plans for a bank which they plan to stee
ttac om lent ct 1	k, the gang obtained the security plans for a bank which they plan to steal
lent	k, the gang obtained the security plans for a bank which they plan to steal ify the offence that has been committed according to the Computer Misuse 990. ert the following denary number into 8-bit two's complement.



4. An instruction to be executed is held in memory location 8211.

Some of the steps required to fetch and execute this instruction are shown below.



Complete the missing steps of the fetch execute cycle using the information provided.

2

Α				

В _____

5. A digital certificate is used when securing data transmission through encryption.

State the purpose of a digital certificate in encrypted data transmission.

2

DO NOT WRITE IN THIS MARGIN

6. The decimal number 12.875 converted to binary is 1100.111

Convert 1100.111 to floating point representation. There are 16 bits for the mantissa (including the sign bit) and 8 bits for the exponent.

3

Space for your calculations

mantissa exponent sign

DO NOT WRITE IN THIS MARGIN

 A Scottish Candidate Number (SCN) is used to identify candidates sitting examinations. It consists of eight integers followed by an integer check digit.

Scottish Candidate Number: 11023021 4

When an SCN is entered into a computer system, the check digit is calculated and compared to the one entered as part of the number. If the two match, then the SCN has been entered correctly.

The check digit is calculated by multiplying each digit by a weight and adding it to a total. The modulus of total divided by 11 is then subtracted from 11 to give the check digit. For example:

Digit	Weight	Example SCN	Digit x Weight
1	3	1	3
2	2	1	2
3	7	0	0
4	6	2	12
5	5	3	15
6	4	0	0
7	3	2	6
8	2	1	2

The total of the digit x weight column is 40.

40 divided by 11 gives a remainder of 7 (the modulus).

11 - 7 = 4, 4 is the check digit.

(a)

` '	how the modulus of total divided by 11 would be calculated and stored in result.					

Using a programming language of your choice, write code to show

7. (continued)

An array, called scn, is used to store the digits of a Scottish Candidate Number ,as shown below. The last digit in the array is the check digit.

	1	2	3	4	5	6	7	8	9
scn	0	7	0	1	6	1	4	0	0

The weights used to calculate the check digit are also stored in an array.

•	1	2	3	4	5	6	7	8
weight	3	2	7	6	5	4	3	2

(b) Using a design technique of your choice, design a solution that will calculate the check digit for an SCN and then check this against the one entered.

The program should display a message with the SCN stating if it is valid or not e.g. 070161400 is a valid SCN

3

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7. (continued)

(c) A focus group is held with candidates who make use of the SCN to sit exams. The output of the focus group is to inform a software development project to make examination results and personal data more accessible.

The group have been discussing the requirements of a new system.



Use the information above to identify an input, a process and an output in terms of functional requirements.

Process:

Output:

DO NOT WRITE IN THIS MARGIN The software for a drinks vending machine has the following design. 8. Drink Vending Machine calculate and issue Payment and deliver product get selected product Selection change change = money · get selected product until money >= price price if change available from machine Is money < price of selection use selection to find get selection issue change get money from user price of selection money display "Enter full payment"

(a) Mark all data flows on the diagram above. The first one, money passed out from the step get money from user, has been done for you.

5

MARKS

8. (continued)

(b) The machine holds the details of products.



Product: Citrus Spring

Selection: D8 Price: 1.70 Stock: 12

(i) The details of a product are held in a record structure.

Using a programming language of your choice, define a suitable record data structure for the data above.

(ii) Using a programming language of your choice, define the variable which can store the details of 40 products held in the vending machine. Your answer should use the record data structure created in part (i).

2

M	Α	K	ς
IV	м	n	

8. (co	ntinued)
--------	----------

(c)	Use selection to find price is a module from the structure diagram.	
	Using your data structures from (b)(i) and (b)(ii) and a design technique of your choice, design an efficient solution to find the price of a drink based on the selection entered.	
	If the selection is not found the price should be set to -99.	5
(d)	A programmer, in the team writing the software has suggested that Unicode should be used to store the details of the selections available. Another programmer in the team says they should use Extended ASCII.	
	Explain why using Unicode may not provide any benefit when compared with Extended ASCII for this program.	2

DO NOT WRITE IN THIS MARGIN

9.	Adcord is an online discussion forum that allows players of computer games to chat together in different rooms. The rooms are named after computer games. Details of which players are members of which rooms are stored in a text file. The number of times that a player has commented in each room is also stored.			<u>v</u>
	Part of the file is shown below.			
	jaarı jaarı meli scar scar scar juga	nial@optonline.net,Control,79 nial@optonline.net,HelloEngineer,100 nial@optonline.net,Driver2,30 nik@optonline.net,OneHundredDays,5 rolan@hotmail.com,Driver2,17 rolan@hotmail.com,HelloEngineer,24 rolan@hotmail.com,Control,81 alator@verizon.net,Control,27 alator@verizon.net,Driver2,19		
	(a)	The data will be stored in parallel 1D arrays.		
		Using a programming language of your choice, declare parallel 1D arrays that can store 5000 of these room memberships.	2	
	(b)	The memberships of rooms are stored in a file called 'adcord.csv'. Using a programming language of your choice, show how this file would be opened.	2	

9. (continued)

(c) During development of the online forum software, a programmer wants to join two strings together. The operator for this is & but the programmer types the following:

fullname = firstname \$ secondname

State the type of error that has occurred.

1

2

- (d) The online forum software displays a rank for users based on the number of comments they have posted. A function for this purpose is shown below.
- Line 55 FUNCTION userRank(INTEGER comment) RETURNS STRING
- Line 56 IF comment < 100 THEN
- Line 57 SET Rank TO "Bronze"
- Line 58 ELSE
- Line 59 IF comment > 100 AND comment < 200 THEN
- Line 60 SET Rank TO "Silver"
- Line 61 ELSE
- Line 62 SET Rank TO "Gold"
- Line 63 END IF
- Line 64 END IF
- Line 65 RETURN Rank
- Line 66 END FUNCTION
 - (i) Complete the trace table using the test data shown.

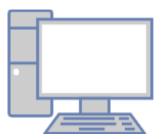
	comment	Rank
Line 55	87	
Line 65		

	comment	Rank
Line 55	350	
Line 65		

	comment	Rank
Line 55	100	
Line 65		

(ii)	A comment value of 100 should return "Silver". Amend line 59 so that
	it functions as expected.

- **10.** A "smart home" makes use of sensors and automation to manage heating, lighting, door locks, alarms and media devices such as speakers and televisions.
 - (a) The "smart home' is managed by a computer system.



8 Core Processor

3.2 GHz Clock Speed

To improve system performance there are two options available. One is to increase the number of processor cores to 16 and the other is to increase the clock speed to 6.4 GHz.

(i)	Describe an advantage of increasing the number of cores for the processor operating the smart home.
ii)	Compare the performance of a processor with 16 cores and a clock speed of 3.2 GHz with a processor of 8 Cores and a clock speed of 6.4 GHz.

10. (continued)

(b) The smart home keeps a record of the temperature in the home based on readings that it takes every 5 minutes. These readings are stored in an array called temp.

temp	16.5	20.2	19.5	•••	20.5	21.2	19.8

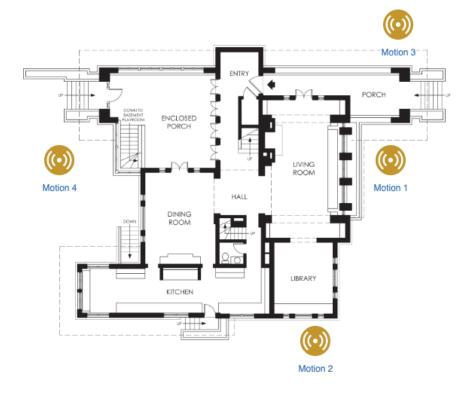
There are 480 readings in a day.

Using a recognised design technique, design an algorithm to find the maximum temperature reading for a day.

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10. (continued)

(c) The smart home monitors security sensors around the home.



The following code is used to monitor the security system.

FUNCTION activateAlarm() RETURNS BOOLEAN

DECLARE motion1 AS BOOLEAN INITIALLY FROM <Motion 1 sensor>
DECLARE motion2 AS BOOLEAN INITIALLY FROM <Motion 2 sensor>
DECLARE motion3 AS BOOLEAN INITIALLY FROM <Motion 3 sensor>
DECLARE motion4 AS BOOLEAN INITIALLY FROM <Motion 4 sensor>
IF motion1 AND motion2 AND motion3 AND motion4 THEN
SET activateAlarm TO True
ELSE
SET activateAlarm TO False
END IF
RETURN activateAlarm
END FUNCTION

Evaluate this code in terms of fitness for purpose.		

[Turn over

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You must complete $\mbox{\it EITHER}$ Section 2 or Section 3

Section 2 - Database Design and Development - Page 18

OR

Section 3 - Web Design and Development - Page 27

[Turn over for Section 2

SECTION 2 - Database Design and Development

Attempt ALL questions if you choose to answer this section

11. A system makes use of the following data.

Session

SessionID	SessionTime	SessionDay		
•••	•••	•••		
2981	10:00 - 10:50	Thursday		
2999	11:00 - 11:50	Thursday		
3002	12:30 - 13:20	Thursday		
3003	16:00 - 17:00	Friday		
•••	•••	•••		

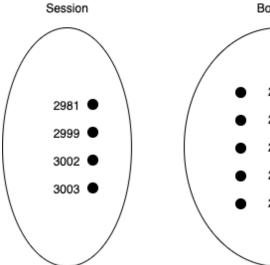
Space

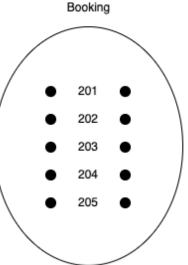
SpaceID	SpaceName	Equipment			
•••	•••	•••			
002	Weights Room	Kettlebells			
009	Weights Room	Sandbells			
012	Spin Studio 1	Cycles			
102	Gym 1	Treadmill			
107	Gym 2	Elliptical			
•••	•••	•••			

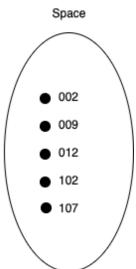
Booking

DOOKING					
Booking ID	SessionID	SpaceID			
•••	•••	•••			
201	2981	009			
202	2999	012			
203	2981	107			
204	3003	002			
205	3003	107			
205	2999	002			
•••	•••	•••			

(a) Complete the entity-occurrence diagram below for the data provided above.







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11. (continued)

(b)	b) State the relationship between:	
	Session and Booking	
	Space and Booking	

12. A database table is shown below.

Product			
productName	category	price	quantity
PRIME TRX40-PRO	Motherboard	129.00	3
ROCK TRX40-PRO	Motherboard	189.99	2
ROG STRIX TRX30	Motherboard	103.50	2
AMD Ryzen 9 5900 X	Processor	499.99	1
AMD Ryzen 7 5800 X	Processor	480.00	1
Intel Core i9 S2066	Processor	539.99	2
Intel Core i5 \$1066	Processor	230.99	4
ASUS Radeon RX 6900	Graphics Card	1799.99	2
ASUS Radeon RX 6800	Graphics Card	1099.99	1
ASRock Radeon RX	Graphics Card	744.98	2

Complete the table below showing the expected output from the following SQL statement.

2

SELECT category, MAX(price) AS 'Most Expensive' FROM product WHERE quantity >=2 GROUP BY category

category	Most Expensive

13. A vet uses the following database about pets and their owners. Each pet has a unique microchip, which can be scanned if the pet is lost or stolen and then found. Where pets are insured by an insurance company, this is also stored.

Pet

PetID	Name	Species	ChipID	Sex	Dob	OwnerID
668	Fluffy	cat	979603	f	2013-04-02	828
669	Claws	cat	324818	m	2014-03-17	828
670	Buffy	dog	782401	f	2019-05-13	830
671	Fang	dog	607059	m	2010-08-27	831
672	Bowser	dog	715053	m	2019-08-31	827
673	Chirpy	bird	508514	f	2020-11-09	828
674	Whistler	bird	584264	f	2020-09-12	828
675	Slim	snake	988321	m	2021-04-29	831
•••	•••	•••	•••	•••	•••	•••

Microchip

Microcinp		
ChipID	MobileNumber	Status
979603	07700 900829	Lost or Stolen
324818	07700 900829	Not Lost or Stolen
782401	07700 900966	Not Lost or Stolen
607059	07700 900945	Not Lost or Stolen
715053	07700 900912	Not Lost or Stolen
508514	07700 900829	Not Lost or Stolen
584264	07700 900829	Not Lost or Stolen
988321	07700 900945	Lost or Stolen
•••		•••

Owner

OwnerID	Firstname	Lastname
827	Harold	Walters
828	Gwen	Wilson
830	Benny	Hill
831	Diane	Keaton
•••	•••	•••

InsuredPets

PetID	InsuranceID	
668	3	
670	2	
671	3	
673	4	
675	4	
	•••	

Company

InsuranceID	Company
1	Direct Pet
2	Safe Care
3	MyPet.com
4	Direct Pet
•••	•••

13. (continued)

(a)	Draw an entity relationship diagram to show the relationships that exist in this database.	
	Your answer should show the entity names and cardinality. Attributes are not required on the diagram.	4

(b) A list of pets with their insurance company is used by the vet.

Write the SQL statement to produce the output shown below.

Name	Company
Fluffy	MyPet.com
Buffy	Safe Care
Fang	MyPet.com
Chirpy	Direct Pet
Slim	Direct Pet

13. (continued)

(c) A report is required to show the status of cats.

Status	Number of Pets	Species
Lost or Stolen	1	cat
Not Lost or Stolen	1	cat

The following SQL statement is executed.

SELECT Microchip.Status, SUM(Microchip.Status), Pet.Species FROM Microchip, Pet WHERE Microchip.ChipID = Pet.ChipID AND pet.Species = "cat"

When tested, the actual output did not match the expected output.

Identify the three errors in the above SQL Statement.

ELLOL I			

Error 2	

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[Turn over for Question 14

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14. A shop called "Digital Life" has a website that allows customers to place orders for the products the shop sells.

Details entered are stored in a relational database.

The shop owners can see the totals of sales for their products, see the value of orders that customers are placing and view their top customers. Customers can view each of the orders they have placed.

	State two functional requirements of the relational database.
_	
-	
-	

(b) Some data stored in the database is shown in the four tables below.

customers

custID	email	name	address	postcode	
1	sally@happyshop.com	Sally Reid	3 Ebony Way, Dundee	DD6 7TQ	
2	hamish@scottidog.net	Hamish McLeod	The Manse, Fordoun	AB16 1AW	
3	azam@warmmail.org	Azam Mohamad	56 Walker Street, Edinburgh	EH54 1FD	
4	const@lambwool.com	Constance Yule	12C Port Street, Inverness	IV23 7JD	
•••				•••	

orders

orderNo	custID	orderDate
1001	1	2021-11-01
1002	2	2021-11-01
1003	3	2021-11-02
1004	2	2021-11-02

orderdetails

orderdetailsID	orderNo	pID	quantity
1	1001	271	1
2	1001	321	1
3	1002	347	3
4	1002	341	1
5	1003	340	1
6	1004	300	2
			•••

products

products		
pID	product	price
271	Panda Pro 6 Phone	840.99
300	Panda 6 Phone	599.99
321	Panda Ear Buds	99.99
340	Digital Life Cam	179.99
341	Digital Life Doorbell	179.99
347	Panda Wifi	89.99
	•••	•••

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14. (b) (continued)

(i) When calculating the total for each order, the following data is calculated.

orderNo	price	quantity	LineTotal
1001	840.99	1	840.99
1001	99.99	1	99.99
1002	89.99	3	269.97
1002	179.99	1	179.99
1003	179.99	1	179.99
1004	599.99	2	1199.98
•••	•••	•••	•••

Design a query to produce this result.

Field(s) and calculations(s)

Table(s)

Search criteria

Grouping

Sort Order

3

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14.(b) (continued)

(ii) The total for each order is calculated and displayed as follows.

orderNo	custID	Order Total
1001	1	940.98
1002	2	449.96
1003	3	179.99
1004	2	1199.98
•••	•••	•••

Design a query to produce this result.

Field(s) and	
calculations(s)	
catcutations(s)	
Table(s)	
Tuble (3)	
Search criteria	
Grouping	
Sort Order	

[END OF SECTION 2]

SECTION 3 - Web Design and Development

Attempt ALL questions if you choose to answer this section

15. A low-fidelity prototype for a new social media site has been created.

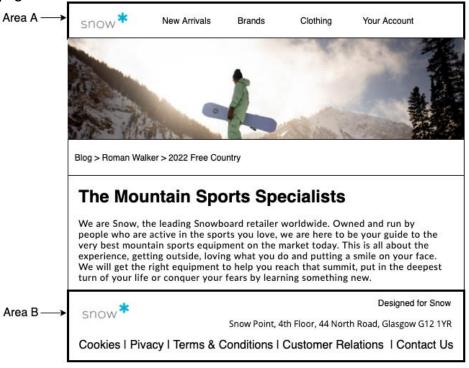
2



Describe how this prototype will be used to carry out usability testing.

2

16. A web page has been created using HTML elements to define areas of the page.



State the HTML element which have been used for area A and area B.

2

Area A

Area B

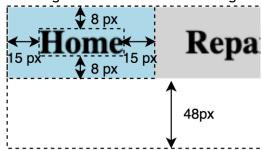
7.	Some	HTML from a web page is shown below.	_
	<h2>0</h2>	Suardians of the universe	
	This h	eading is to be blue and float to the left.	_
ſ	Rewrit requir	te the HTML above to include inline CSS code to format the text as ed.	2
•	consist Tourin	Tech Ltd is developing a web site. The website will be multi-level, ting of a home page and pages for each of the following: Repairs, Setup, ng, Contact Us. Repairs has two subpages: Acoustic, Electric. Touring has ubpages: Photos and Blog.	
	(a)	Design a multi-level structure for this website.	2

18 (continued)

(b) The site has a horizonal navigation bar. The HTML for the navigation bar is shown below.

```
    <a href="home.html" class="active">Home</a>
    <a href="repairs.html">Repairs</a>
    <a href="setup.html">Setup</a>
    <a href="touring.html">Touring</a>
    <a href="contact.html">Contact Us</a>
```

A wireframe for the navigation bar has the following dimensions.



Complete the missing properties of the CSS below to format the menu as required.

4

```
ul.horizontal {
  width: 100%;
  float: left;
  margin: _
  padding: 0;
  list-style:
  background-color: lightgrey;
ul.horizontal li {
  float: left;
ul.horizontal li a {
  display:
  padding: _
  text-decoration: none;
  font-weight: bold;
  color: black;
}
ul.horizontal li a.active {
  background-color: lightblue;
```

DO NOT WRITE IN THIS MARGIN

18. (continued)

(c) Explain why descendant selectors are used in (b)

(d) The Touring page from the Guitar Tech Ltd site is shown below.



When the page loads, and the mouse pointer is not on the image, screen A is shown. When the mouse is moved over the image, Screen B is shown.

When the mouse is moved back off the image, it should return to Screen A, but currently it does not.

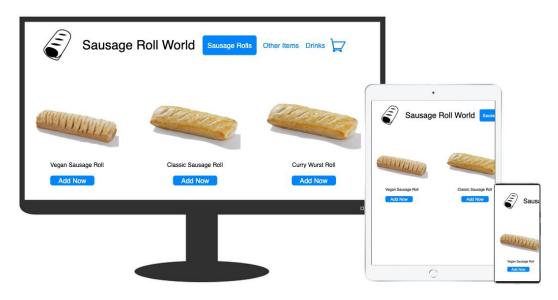
HTML Code for parts of the page are shown below.

```
<script>
  function swapimage(guitarpic) {
               guitarpic.src="guitar2.png";
</script>
</head>
. . .
<main>
 <div style="width:500px">
  <image src="guitar1.png" onmouseover="swapimage(this);"</pre>
 </div>
 <div style="text-align: center; width:500px">
    <a href="photos.html">Tour Photos</a> |
    <a href="blog.html">Tour Blog</a>
  </h3>
 </div>
</main>
```



18. (d)	(contir	nued)	MARKS	DO NOT WRITE IN THIS MARGIN
	(i)	Write the JavaScript function to display the original image when the mouse is moved off the image.	2	
	(ii)	Rewrite the HTML element to call the function created in part (i) when the mouse is moved off the image.	2	
			_	

19. A low-fidelity prototype of a web site for ordering sausage rolls has been created.



The prototype displays as expected on a desktop computer but there are (a) issues on other device types.

Explain the role of compatibility testing as part of the development of a web site.

(b) Compatibility testing should also be carried out with different web

browsers. Explain why testing using a range of web browsers is required.

19. (continued)

- (c) A page on the sausage roll web site allows customers to enter their payment details for their order. When using the form, customers will need to submit the following information.
 - Name
 - Card number (16 digits)
 - Card expiry (2 digits month, 2 digits year)
 - Card CCV Number (3 digits)
 - Order note (max of 500 characters)

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ADDITIONAL SPACE FOR ANSWERS

ADDITIONAL SPACE FOR ANSWERS