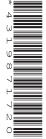


Cambridge International Examinations

Cambridge International Advanced Level

CANDIDATE NAME				
CENTRE NUMBER		NDIDATE MBER		



COMPUTER SCIENCE

9608/33

Paper 3 Advanced Theory

October/November 2016

1 hour 30 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer **all** questions.

No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

The maximum number of marks is 75.



- 1 In a particular computer system, real numbers are stored using floating-point representation with:
 - 12 bits for the mantissa
 - 4 bits for the exponent
 - two's complement form for both mantissa and exponent

(a)	Calculate the floating-point	representation of	r +2.5 in this	system.	Snow your	working.

Mantissa											Expo	onent	t	
•														
								•••••		•••••	 			
Calcula		e float	ing-p	oint re	epres	entat	ion o							
 Calcula	ute the	float	ing-p	oint re			ion o					w you		king.
Calcula	ate the	e float	ing-p				ion o					w you	r worl	king.
Calcula	ate the	e float	ing-p				ion o					w you	r worl	king.
Calcula	ate the	e float	ing-p				ion o					w you	r worl	king.
Calcula	ate the	e float	ing-p				ion o					w you	r worl	king.
Calcula	ate the	e float	ing-p				ion o					w you	r worl	king.
calcula	ate the	e float	ing-p				ion o					w you	r worl	king.
Calcula	ate the	e float	ting-p				ion o					w you	r worl	king.

(c) Find the denary value for the following binary floating-point number. Show your working.

					Man	tissa								Expo	onent	•	
0	0	1	1	0	0	0	0	0	0	0	0		0	0	1	1	
			1		ı	'						ı					
																	[3
(i)	St	ate w	hethe	r the	floatir	ng-poi	int nu	mber	giver	n in p a	art (c)	is no	ormal	ised (or not	norm	alised
																	[1]
(ii)	Ju	stify y	our a	nswe	r give	n in p	oart (d)(i).									
																	[1
Th	e sy																
																·	
											•						
-																	
2					••••••				•••••	•••••							
۷					•••••	•••••			•••••								٠٠٠٠٠٠٠
	(i) Th	(i) St	(i) State w (ii) Justify y The system State two ef	(ii) State whether (iii) Justify your and the system change State two effects 1	(i) State whether the final distribution of the system changes so State two effects this had a simple of the system changes and state two effects this had a simple of the system changes and state two effects this had a simple of the system changes and state two effects this had a simple of the system changes and state two effects this had a simple of the system changes and state two effects this had a simple of the system changes and state two effects this had a simple of the system changes and state the system changes are simple of the system changes and state two effects this had a simple of the system changes and state two effects this had a simple of the system changes and state two effects this had a simple of the system changes and state two effects this had a simple of the system changes and state two effects the system changes are simple of the system changes and state two effects the system changes are simple of the system changes and state two effects the system changes are simple of the system.	(i) State whether the floating (ii) Justify your answer gives The system changes so that State two effects this has on 1	(ii) State whether the floating-poi	(i) State whether the floating-point nut. (ii) Justify your answer given in part ((i) State whether the floating-point number (ii) Justify your answer given in part (d)(i). The system changes so that it now allocates State two effects this has on the numbers the	(i) State whether the floating-point number giver (ii) Justify your answer given in part (d)(i). The system changes so that it now allocates 8 bit State two effects this has on the numbers that can 1	(i) State whether the floating-point number given in part (d)(i). The system changes so that it now allocates 8 bits to be State two effects this has on the numbers that can be in the system of the system changes.	(i) State whether the floating-point number given in part (c) (ii) Justify your answer given in part (d)(i). The system changes so that it now allocates 8 bits to both the State two effects this has on the numbers that can be representation.	(i) State whether the floating-point number given in part (c) is not like it. (ii) Justify your answer given in part (d)(i). The system changes so that it now allocates 8 bits to both the mass state two effects this has on the numbers that can be represented.	(i) State whether the floating-point number given in part (c) is normal (ii) Justify your answer given in part (d)(i). The system changes so that it now allocates 8 bits to both the mantiss State two effects this has on the numbers that can be represented.	(i) State whether the floating-point number given in part (c) is normalised (ii) Justify your answer given in part (d)(i). The system changes so that it now allocates 8 bits to both the mantissa and State two effects this has on the numbers that can be represented.	(i) State whether the floating-point number given in part (c) is normalised or not (ii) Justify your answer given in part (d)(i). The system changes so that it now allocates 8 bits to both the mantissa and the content of the state two effects this has on the numbers that can be represented.	(i) State whether the floating-point number given in part (c) is normalised or not norm (ii) Justify your answer given in part (d)(i). The system changes so that it now allocates 8 bits to both the mantissa and the expon State two effects this has on the numbers that can be represented.

2	There are four stages in the compilation	of a program written in a high-level language.

(a) Four statements and four compilation stages are shown below.

Draw a line to link each statement to the correct compilation stage.

Statement	Compilation stage
This stage removes any comments in the program source code.	Lexical analysis
This stage could be ignored.	Syntax analysis
This stage checks the grammar of the program source code.	Code generation
This stage produces a tokenised version of the program source code.	Optimisation
	[4]
Write the Reverse Polish Notation (RPN) for(i) (A + B) * (C - D)	the following expressions.
	[2]
(ii) -A / B * 4 / (C - D)	[3]

(c) An interpreter is executing a program. The program uses the variables w, x
--

The program contains an expression written in infix form. The interpreter converts the infix expression to RPN. The RPN expression is:

$$x w z + y - *$$

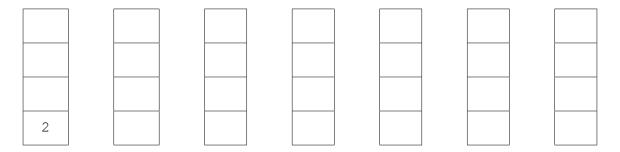
The interpreter evaluates this RPN expression using a stack.

The current values of the variables are:

$$w = 1$$
 $x = 2$ $y = 3$ $z = 4$

(i) Show the changing contents of the stack as the interpreter evaluates the expression.

The first entry on the stack has been done for you.



[4]

(ii) Convert back to its original infix form, the RPN expression:

......[2]

(iii) Explain **one** advantage of using RPN for the evaluation of an expression.

3 A computer operating system (OS) uses paging for memory management.

In paging:

- main memory is divided into equal-size blocks, called page frames
- each process that is executed is divided into blocks of the same size, called pages
- each process has a page table that is used to manage the pages of this process

The following table is the incomplete page table for a process X.

Page	Presence flag	Page frame address	Additional data
1	1	132	
2	1	245	
3	1	232	
4	0	0	
5	1	542	
6	0	0	
	7		
135	0	0	

When a particular page of the process is currently in main memory, the Presence flag entry in the page table is set to 1.

If the page is not currently present in memory, the Presence flag is set to 0.

(a)	The page frame address entry for Page 2 is 245.
	State what the value 245 could represent.
	[1]
(b)	Process X executes until the next instruction is the first instruction in Page 4. Page 4 is not currently in main memory.
	State a hardware device that could be storing this page.
	[1]

(c)	When an instruction to be accessed is not present in main memory, its page must be loaded
	into a page frame. If all page frames are currently in use, the contents of a page frame will be
	overwritten with this new page.

The page that is to be replaced is determined by a page replacement algorithm.

One possible algorithm is to replace the page that has been resident in main memory for the longest time.

(i)	Give the additional data that would need to be stored in the page table.
	[1

(ii) Complete the table entries below to show what happens when Page 4 is swapped into main memory. Assume that Page 5 is the one to be replaced.

In the final column, give an example of the data you have identified in part (c)(i).

Page	Presence flag	Page frame address	Additional data
4			
		7	7

г	\sim	٦
	٠.	

An alternative algorithm is to replace the page that has been used least.

(iii)	Give the different additional data that the page table would now need to store
1111<i>1</i>	aive the unlerent additional data that the bade table would now need to store

 [1]

(iv) In the following table, complete the missing data to show what happens when Page 3 is swapped into main memory. Assume that Page 1 is the one to be replaced.

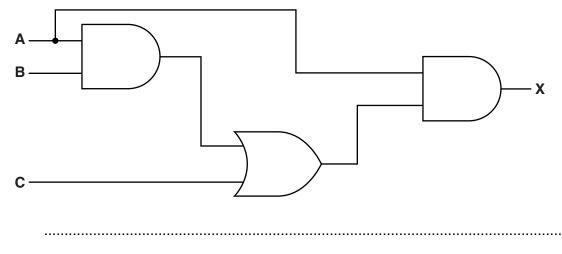
In the final column, give an example of the data you have identified in part (c)(iii).

Page	Presence flag	Page frame address	Additional data
3			
	7		

	plain why the algorithms given in part (c) may not nagement.	be the b	est cho	oice for e	efficier
Lor	ngest resident				
Lea	ast used				
(i)	Complete the truth table for this logic circuit.				
χ.		lnı	out	Out	tput
γ -) A	X	Y 0	Α	В
-		0	1		
	В	1	0		
		'	1		
(ii)	State the name given to this logic circuit.				
iii)	Name the labels usually given to A and B .				
,	Label A				
	Label B				
	Explain why your answers are more appropriate	for the A	and B	labels.	

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(b) (i) Write the Boolean expression corresponding to the following logic circuit:



(ii)	Use Boolean algebra to simplify the expression that you gave in part (b)(i).
	Show your working.

The	TCF	P/IP protocol suite ca	an be viewed as a stack with four laye	ers.
(a)	(i)	Complete the stack	k by inserting the names of the three	missing layers.
				_
			Transport	
				_
				[3]
	<i>a</i> ns			[3]
	(ii)	State how each lay	ver of the stack is implemented.	
				[1]
(b)	A c	omputer is currently	running two processes:	
	•	Process 1 is downl	loading a web page.	
	•	Process 2 is downl	oading an email.	
	(i)	Describe two tasks downloaded correct	s that the Transport layer performs to ctly.	ensure that the incoming data is
		1		
		2		
		<u> </u>		
				[4]
	(ii)	Name a protocol th	nat will be used by Process 1.	
				[1]
	(iii)	Name a protocol th	nat will be used by Process 2.	
	(111)	rvaine a protocol ti	ial will be used by F100ess 2.	- 13

6 (a) The table below gives descriptions of three types of malware.

Description	Term
Malware that attaches itself to another program.	
Malware that redirects the web browser to a fake website.	
Email that encourages the receiver to access a website and give their banking details.	

	gi	/e their banking details.			
	Complete the table by adding the correct terms.				
(b)		wants to send a highly confidential email to Mariah so that cipher text will be used in this communication.	only she can read it	Plain text	
	(i)	Explain the terms plain text and cipher text.			
		Plain text			
		Cipher text			
				[2]	
	(ii)	Explain how the use of asymmetric key cryptography ensuthe email.	ıres that only Mariah	ı can read	

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