

6(a)	1 mark for each correct description, max 2 marks <table border="1"> <thead> <tr> <th>Register</th><th>Role</th></tr> </thead> <tbody> <tr> <td>ACC</td><td>stores the intermediate results of arithmetic and logical operations // holds the result of a calculation</td></tr> <tr> <td>CIR</td><td>holds the instruction currently being decoded and/or executed</td></tr> </tbody> </table>	Register	Role	ACC	stores the intermediate results of arithmetic and logical operations // holds the result of a calculation	CIR	holds the instruction currently being decoded and/or executed
Register	Role						
ACC	stores the intermediate results of arithmetic and logical operations // holds the result of a calculation						
CIR	holds the instruction currently being decoded and/or executed						
6(b)	1 mark per bullet point, max 2 marks e.g. • Latency may be increased • ... because the cores must communicate with one another • There is a potential for dead-lock situations • ... where one core may wait for information from other cores which in turn are waiting for the first one • Not all software is designed to use multi-cores • ... so some of the additional cores would be idle • Increased heat generation • ... which could cause damage to other components						
6(c)	1 mark per bullet point, max 3 marks • DRAM requires to be refreshed/charged SRAM does not request a refresh • DRAM stores each bit as charge SRAM uses flip-flop to store each bit • DRAM is less expensive to manufacture SRAM is more expensive to manufacture • DRAM has slower access speeds SRAM has faster access times • DRAM has higher <u>storage/bit/data density</u> SRAM has lower storage/bit/data density • DRAM is used in main memory SRAM is used in cache						
9	1 mark per bullet point, max 3 marks • Monitoring systems do not take any action whereas control systems act autonomously to change the environment if the values are out of a prescribed range • Control systems use actuators monitoring systems do not have any actuators • Control systems make use of feedback monitoring systems do not make use of feedback • The output from a monitoring system does not affect the subsequent input whereas output from a control system affects the next input.						

10(a)	1 mark per bullet point, max 3 marks Generic mark points: (max 3) - Additive manufacturing - Uses a digital file created from 3D modelling software or Computer Aided Design (CAD) software - The printer builds up the model one layer at a time - The process is repeated for each layer - Some materials may need time to cool and set or UV curing using LEDs for photopolymer resins Specific mark points: (max 1) e.g. - Fused Deposition Modelling (FDM) // Material is heated and pushed through nozzle / extruder - Stereolithography (SLA) // Photosensitive liquid resin is exposed to a UV-laser beam - Digital Light Processing (DLP) // Photosensitive liquid resin is exposed to a UV projected image of the layer to cure the resin - Selective Laser Sintering (SLS) // Uses a laser to form objects from powdered material, the material can be plastics or metals
10(b)	1 mark - To free up the processor to carry out other tasks as the rate data is received by the printer is different from the rate at which it can be processed - To manage the mismatch in speed between the processor and the peripheral / 3D printer

9(a)	1 mark per bullet point, max 2 marks - NOT (A XOR B) - NAND ((B AND C) OR A) X = (NOT (A XOR B)) NAND ((B AND C) OR A) // X = ((B AND C) OR A) NAND (NOT (A XOR B))
9(b)	1 mark for 1 or 2 row numbers correct, 2 marks all three correct Row 2 Row 4 Row 7

6(a)

- **One** mark for working, (all four columns P, Q, R and S)
- **One** mark for first four rows of column Z
- **One** mark for second four rows of column Z

			Working space					
A	B	C	P	Q	R	S	Z	
0	0	0	1	1	0	0	1	
0	0	1	1	1	1	1	1	
0	1	0	0	0	1	0	1	
0	1	1	0	0	0	0	0	
1	0	0	1	0	0	0	1	
1	0	1	1	0	1	0	1	
1	1	0	0	1	1	0	1	
1	1	1	0	1	0	0	0	

6(b)(i)

Two marks if no errors present
One mark if only one error present

A \ BC				
	00	01	11	10
0	0	1	1	0
1	0	1	0	1

6(b)(ii)

One mark for each correct loop (**Max 2**)

A \ BC				
	00	01	11	10
0	0	1	1	0
1	0	1	0	1

6(b)(iii)

One mark for each mark point (**Max 2**)

- One correct Boolean term with a + / OR sign
- All Boolean terms and operators correct and no other terms present

$$\bar{A}.C + \bar{B}.C + A.B.\bar{C}$$

4(a)	1 mark each: • $X = (R \text{ NOR } S) \text{ XOR } T$ • $Y = (T \text{ AND } U) \text{ OR } U$																																													
4(b)	1 mark for first four rows, 1 mark for second four rows <table><tr><th>A</th><th>B</th><th>C</th><th>Working space</th><th>X</th></tr><tr><td>0</td><td>0</td><td>0</td><td></td><td>1</td></tr><tr><td>0</td><td>0</td><td>1</td><td></td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td><td></td><td>1</td></tr><tr><td>0</td><td>1</td><td>1</td><td></td><td>1</td></tr><tr><td>1</td><td>0</td><td>0</td><td></td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td><td></td><td>0</td></tr><tr><td>1</td><td>1</td><td>0</td><td></td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td><td></td><td>1</td></tr></table>	A	B	C	Working space	X	0	0	0		1	0	0	1		1	0	1	0		1	0	1	1		1	1	0	0		1	1	0	1		0	1	1	0		0	1	1	1		1
A	B	C	Working space	X																																										
0	0	0		1																																										
0	0	1		1																																										
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1	1	1		1																																										

1(a)	1 mark for: $(A \text{ XOR } B) \text{ NOR } C$
1(b)	1 mark for NOT B XOR C 1 mark for NOT A and final AND plus NOT