

4(a)	1 mark for each correct statement $X = B \text{ NOR } (A \text{ NOR } C)$ $Y = (B \text{ AND } C) \text{ XOR NOT } D$																																													
4(b)	1 mark for 1st 4 rows 1 mark for 2nd 4 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>0</td></tr><tr><td>1</td><td>0</td><td>0</td><td></td><td>0</td></tr><tr><td>1</td><td>0</td><td>1</td><td></td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td><td></td><td>1</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		0	1	0	0		0	1	0	1		1	1	1	0		1	1	1	1		1
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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.
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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
11	1 mark per bullet point, max 3 marks Identification: Control system (no mark) Justification: - The system uses an actuator to open or close the doors - The output / opening the doors allows people to move, which changes the input to the sensor - The system acts autonomously on the feedback from a sensor

3	1 mark for each bullet point (max 3) • The system uses feedback • The system acts independently • Input data causes the car to brake • ... braking decreases the/changes the distance to the object • ... this new distance is used to determine whether/how hard the car needs to brake
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1(a)	1 mark for: (A XOR B) NOR C
1(b)	1 mark for NOT B XOR C 1 mark for NOT A and final AND plus NOT

9(a)	1 mark for sensor and its use in this system • Infra-red sensor • Measure / check the height of the vehicle • Pressure sensor • Measure / check the weight of the vehicle
9(b)	1 mark for each bullet point (max 2) for a correct justification No marks for the identification of the system Monitoring system • Because there is no use of feedback // the warning sign is only an indicator • ... the output of the turning on of the sign does not affect the input of data from the sensors • The system does not have any actuators