<table>
<tr><th colspan="2">Question</th><th></th><th>Marks</th></tr>
<tr><td>1</td><td>1</td><td>Mark for AO1 (knowledge)

Zero or more (of the preceding element/character/value);
A. any number of the preceding element/character/value</td><td>1</td></tr>
<tr><td>1</td><td>2</td><td>Mark for AO1 (knowledge)

Zero or one (of the preceding element/character/value) // (the preceding element/character/value is) optional;</td><td>1</td></tr>
<tr><td>1</td><td>3</td><td>All marks AO2 (apply)

<table>
<tr><th>String</th><th>Belongs to language (Y/N)?</th></tr>
<tr><td>1</td><td>Y</td></tr>
<tr><td>11</td><td>N</td></tr>
<tr><td>01</td><td>Y</td></tr>
<tr><td>0111</td><td>Y</td></tr>
<tr><td>0101</td><td>N</td></tr>
<tr><td>111</td><td>N</td></tr>
<tr><td>0011</td><td>N</td></tr>
</table>
Mark as follows:

1 mark: four rows correct
2 marks: five rows correct
3 marks: all seven rows correct</td><td>3</td></tr>
</table>

Question			Marks
2	1	**All marks for AO2 (analyse)** The intersection of **B** with the union of **D** and **E** **//** The union of **E** with the intersection of **B** and **D** **Alternative answer** **B** ∩ (**D** ∪ **E**) // **E** ∪ (**D** ∩ **B**) **Mark as follows** 1 mark for using the sets **B**, **D** and **E** **R.** if answer also uses set **C** 1 mark for the union of set **E** with another set 1 mark for using the intersection operation with set **B** and another set **Max 2 marks** if any errors **A.** answers using alternative set notations **I.** intersection with set **A**	**3**
2	2	**Mark is for AO2 (analyse)** **A** and **B**;	**1**
2	3	**Mark is for AO2 (analyse)** Because there could also be items in a container object (that is in the current location); **A.** explanation that uses an example eg if player is in the cellar the black die is getable even though it is in a container (the shelf) not the cellar.	**1**
2	4	**Mark is for AO1 (understanding)** A set is a subset of itself but not a proper subset of itself // There will be at least one value in a set that is not in a proper subset of that set (that does not have to be case for a subset);	**1**

<table>
<tr><th colspan="2">Question</th><th></th><th>Marks</th></tr>
<tr><td>3</td><td>1</td><td>All marks AO1 (understanding)

<table>
<tr><th>Statement</th><th>True or False?</th></tr>
<tr><td>All regular languages can be represented using a finite state machine without outputs.</td><td>True</td></tr>
<tr><td>The set of strings defined by a regular language is always finite in size.</td><td>False</td></tr>
<tr><td>There are some languages which can be represented in Backus-Naur Form (BNF) that are not regular languages.</td><td>True</td></tr>
</table>

Mark as follows:

1 mark: two rows correct
1 mark: all three rows correct</td><td>2</td></tr>
</table>

<table>
<tr><th colspan="2">Question</th><th></th><th>Marks</th></tr>
<tr><td>4</td><td>1</td><td>All marks AO2 (analyse)

<table>
<tr><th>Current state</th><th>Input</th><th>New state</th></tr>
<tr><td>S2</td><td>a</td><td>S5</td></tr>
<tr><td>S2</td><td>b</td><td>S4</td></tr>
<tr><td>S0</td><td>b</td><td>S2</td></tr>
<tr><td>S5</td><td>b</td><td>S2</td></tr>
</table>

Mark as follows:

• 1 mark: rows with current state of S2 are correct
• 1 mark: rows with new state of S2 are correct

I. order of rows</td><td>2</td></tr>
<tr><td>4</td><td>2</td><td>All marks AO2 (analyse)

<code>a(ba)*|b(ab)*</code>
//
<code>(a(ba)*)|(b(ab)*)</code>
//
<code>b(ab)*| a(ba)*</code>
//
<code>(b(ab)*)| (a(ba)*)</code>
//
<code>a|b|b(ab)+| a(ba)+</code>;;;

Max 2 if not fully correct

If answer is not completely correct award marks for the following:
• Expression uses two <code>*</code> metacharacters and a <code>|</code> metacharacter;
• <code>(ba)*</code> and <code>(ab)*</code> in expression; R. <code>ba*</code> R. <code>ab*</code>
• Expression will match with single <code>a</code> and a single <code>b</code>
• <code>(ba)+</code> and <code>(ab)+</code> in expression; R. <code>ba+</code> R. <code>ab+</code></td><td>3</td></tr>
</table>

Question			Marks

5		**Mark is for AO2 (apply)**
		
		`D|P`
		//
		`[DP]`
		//
		`P|D`
		//
		`[PD];`
		
		I. use of quotes around each character
		A. use of `^` and/or `$` in expression as long as done correctly
			1

<table>
<tr><th colspan="2">Question</th><th></th><th>Marks</th></tr>
<tr><td>6</td><td>1</td><td>All marks AO2 (analyse)

<table><tr><th>Language</th><th>Regular language (Y/N)?</th></tr><tr><td>Language A</td><td>N</td></tr><tr><td>Language B</td><td>Y</td></tr><tr><td>Language C</td><td>Y</td></tr><tr><td>Language D</td><td>Y</td></tr><tr><td>Language E</td><td>Y</td></tr><tr><td>Language F</td><td>Y</td></tr></table>
Mark as follows:

1 mark: any two rows correct
2 marks: any four rows correct
3 marks: all rows correct

A. any suitable alternative to N and Y</td><td>3</td></tr>
<tr><td>6</td><td>2</td><td>All marks AO2 (apply)

a | ab | b+;;

If final answer incorrect award a maximum of 1 mark for any of:
• a | ab
• b+

Alternative answer

ab? | b+;;

If final answer incorrect award a maximum of 1 mark for any of:
• ab?
• b+</td><td>2</td></tr>
<tr><td>6</td><td>3</td><td>Mark is for AO1 (knowledge)

The number of elements/items in a set; A. the size of a set</td><td>1</td></tr>
</table>

Question			Marks
7	1	**Mark is for AO1 (knowledge)** The number of members of a set // the number of elements in a set; **A.** the size of a set	1
7	2	**Mark is for AO2 (apply)** The empty set is also a subset of **R** // {}/ Ø is also a subset of **R**; **NE.** they are not the only subsets of **R**	1
7	3	**Mark is for AO2 (apply)** 1 // one;	1
7	4	**Mark is for AO1 (understanding)** It means either the element (immediately) before or the element (immediately) after // or // alternation;	1
7	5	**All marks AO2 (apply)** a(bb)*|(bb)+ **Mark as follows:** **1 mark:** expression contains a(bb)* **R.** bb* **1 mark:** expression contains (bb)+ **R.** bb+ **Max 1 mark if any errors** **Alternative answer** a|a?(bb)+ **Mark as follows:** **1 mark:** expression contains a|a? **1 mark:** expression contains (bb)+ **R.** bb+ **Max 1 mark if any errors**	2

		Alternative answer (a|bb)(bb)* **Mark as follows:** **1 mark:** expression contains a|bb **1 mark:** expression contains (bb)* **R.** bb* **Max 1 mark if any errors**	

7	**6**	**All marks AO2 (apply)** (ab|b)(bb)* **Mark as follows:** **1 mark:** expression contains ab|b // (ab)|b **1 mark:** expression contains (bb)* **R.** bb* **Max 1 mark if any errors** **Alternative answer** a?b(bb)* **Mark as follows:** **1 mark:** expression contains a?b **1 mark:** expression contains (bb)* **R.** bb* **Max 1 mark if any errors** **Note for examiners** Any regular expression that would match with an expression that starts with an optional a followed by a compulsory b should get (at least) one mark.	**2**