



4.4.2.3 Regular Expressions

1) A regular expression is a way of describing a set.

a) Write down two different regular expressions that describe the set $\{a, ab\}$.

[2 marks]

b) Explain the functionality of the $|$ (vertical bar) metacharacter when it is used in a regular expression.

[1 mark]

Figure 1 shows sets **S** and **T**. Three dots (...) means the remaining members of the set follow the same pattern as the previous members of the set..

Figure 1

$S = \{a, abb, abbbb, abbbbbb, \dots\}$

$T = \{bb, bbbb, bbbbbb, \dots\}$

The members of the set **V** are strings that match the regular expression $a?b^+$

Set **W** is formed by the union of sets **S** and **T**.

Set **X** is formed by the set operation $V - W$.

c) Write a regular expression that would match with all the members of the set **W**.

[2 marks]

d) Write a regular expression that would match with all the members of the set **X**

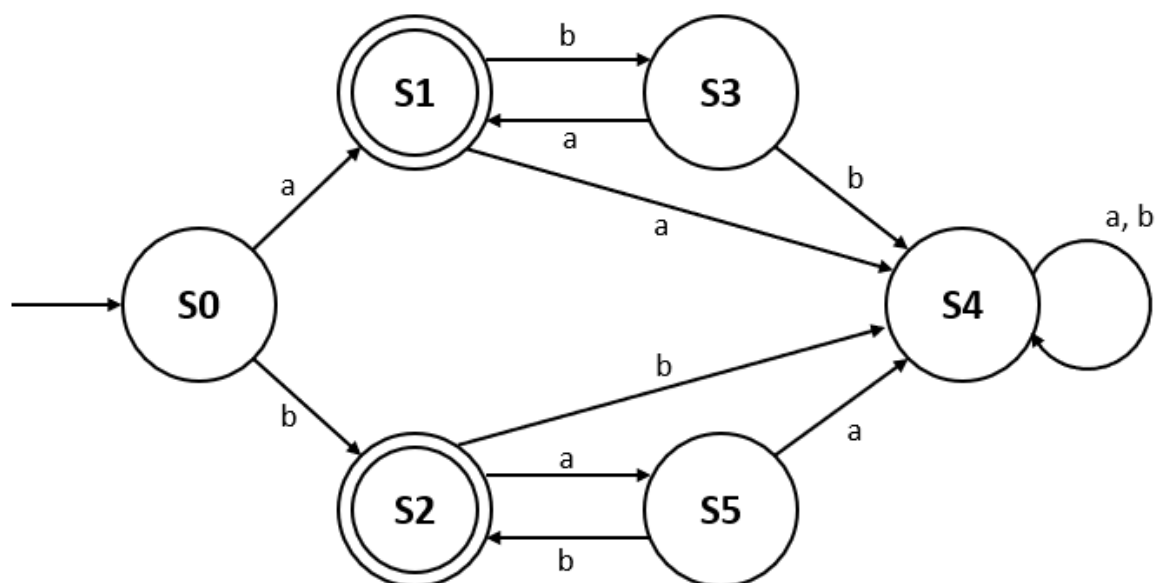
[2 marks]





2) The state transition diagram for a finite state machine (FSM) is shown in **Figure 2**.

Figure 2



a) Regular expressions can be used to recognise the same strings as FSMs without output.

Write a regular expression that will recognise the same set of strings that are accepted by the FSM shown in **Figure 2**.

[3 marks]

b) Explain the functionality of the * metacharacter when it is used in a regular expression.

[1 mark]

c) Explain the functionality of the ? metacharacter when it is used in a regular expression.

[1 mark]





- d) Complete **Table 1** to show which of the strings belong to the language defined by the regular expression $1|01^+$.

Table 1

String	Belongs to language (Y/N)?
1	
11	
01	
0111	
0101	
111	
0011	

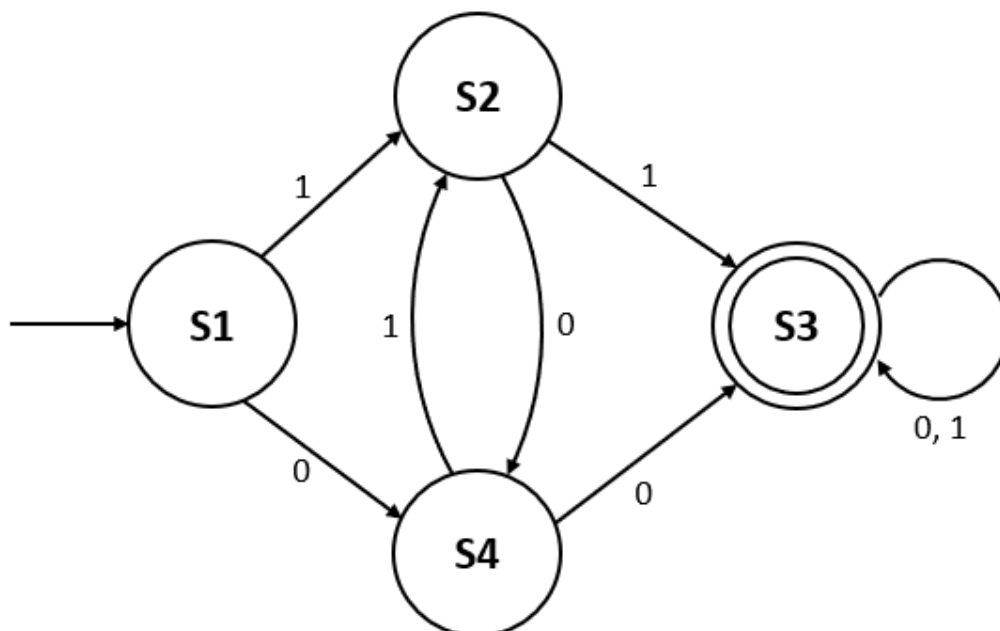
[3 marks]





- 3) A finite state machine (FSM) can be used to define a language: a string is allowed in a language if it is accepted by the FSM that represents the rules of the language. **Figure 3** shows the state transition diagram for an FSM.

Figure 3



Write a regular expression that will recognise the same set of strings that are accepted by the FSM shown in **Figure 3**.

[3 marks]

