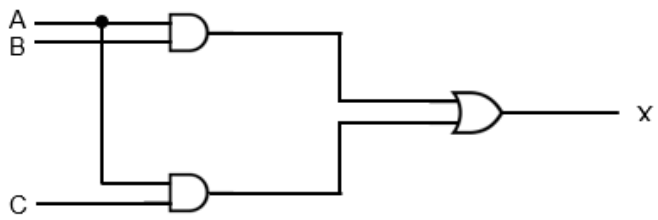
End of chapter questions

1 a) $A.B.C + A.\overline{B}.C + A.B.\overline{C}$

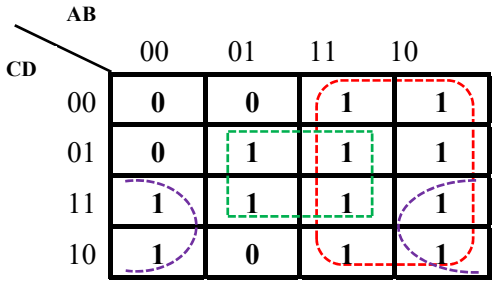
b) A.B + A.C

AB / C	00	01	11	10
0	**0**	**0**	**1**	**0**
1	**0**	**0**	**1**	**1**

c)



2 a) i) ii) $A + B.D + \overline{B}.C$



b) i)

$(A + C).(A.D + A.\overline{D}) + A.C + C$
$\Rightarrow (A.C).A.(D + \overline{D}) + A.C + C$
$\Rightarrow (A + C).A + A.C + C$
$\Rightarrow A.\big((A + C) + C\big) + C$
$\Rightarrow A.(A + C) + C$
$\Rightarrow A.A + A.C + C$
$\Rightarrow A + (A + 1).C$
$\Rightarrow A + C$

ii)

$\overline{A}.(A + B) + (B + A.A).(A + \overline{B})$
$\Rightarrow \overline{A}.A + \overline{A}.B + (B + A).A + (B + A).\overline{B}$
$\Rightarrow \overline{A}.B + (B + A).A + (B + A).\overline{B}$
$\Rightarrow \overline{A}.B + B.A + A.A + B.\overline{B} + A.\overline{B}$
$\Rightarrow \overline{A}.B + B.A + A + A.\overline{B}$
$\Rightarrow \overline{A}.B + A(B + 1 + \overline{B})$
$\Rightarrow \overline{A}.B + A$
$\Rightarrow (A + \overline{A}).(A + B)$
$\Rightarrow A + B$

3 a) i)

INPUTS		OUTPUTS		
S	**R**	**Q**	$\overline{\textbf{Q}}$	**comment**
1	0	1	0	
0	0	1	0	following S = 1 change
0	1	0	1	
0	0	0	1	following R = 1 change
1	1	0	0	

ii) S = 1, R = 1, Q = 0, $\overline{Q}$ = 0 this is an invalid case since Q should be the compliment (opposite) of Q

b) i) two input values, J and K, and synchronisation (clock pulse) input

ii) uses a toggle which removes the invalid S, R states when using SR flip-flop

iii) Uses

- Several JK flip-flops can be used to produce SHIFT REGISTERS in a computer.

b i) Massive – many processors linked together.

ii) Parallel – to perform a set of coordinated computations simultaneously.

c) Hardware – processors need to be able to communicate so that processed data can be transferred from one processor to another.

Software – suitable software which allows data to be processed by multiple processors simultaneously.

6 a) $S = \left(\overline{P} + \overline{(Q + R)}\right).R$

b)

P	Q	R	S
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

c i) ii)

R \ PQ	00	01	11	10
0	**0**	**0**	**0**	**0**
1	**1**	**1**	**0**	**0**

iii) $S = \overline{P}.R$

d)

$S = \left(\overline{P} + \overline{(Q + R)}\right).R$

$\Rightarrow S = \left(\overline{P}.(\overline{Q}.\overline{R})\right).R$

$\Rightarrow S = (\overline{P}.R) + (\overline{Q}.\overline{R}.R)$

$\Rightarrow S = \overline{P}.R + \overline{Q}.0$

$\Rightarrow S = \overline{P}.R + 0$

$\Rightarrow S = \overline{P}.R$