

MATCH ITEMS

Match the following:-

Q1.

<i>A</i>	$(00)^*$	<i>1</i>	<i>Set of all 0's</i>
<i>B</i>	$0(00)^*$	<i>2</i>	<i>Set of all even number of 0's</i>
<i>C</i>	$00(00)^*+0(00)^*$	<i>3</i>	<i>Set of all odd number of 0's</i>
<i>D</i>	0^*	<i>4</i>	<i>Set of all 0's excluding ϵ</i>
		<i>5</i>	<i>Set of all 0's which are multiples of three and four</i>
		<i>6</i>	<i>Set of all 0's which are multiples of three</i>

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
- (ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
- (iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
- (iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q2.

<i>A</i>	$(00)^*(11)^*$	<i>1</i>	<i>Set of all strings over $\{0,1\}$ not containing a 1</i>
<i>B</i>	$0(00)^*(11)^*$	<i>2</i>	<i>Set of all even number of 0's followed by an even number of 1's</i>
<i>C</i>	$00(00)^*+0(00)^*$	<i>3</i>	<i>Set of all odd number of 0's followed by an even number of 1's</i>
<i>D</i>	0^*	<i>4</i>	<i>Set of all 0's excluding ϵ</i>
		<i>5</i>	<i>Set of all 0's which are multiples of three and four</i>
		<i>6</i>	<i>Set of all 0's which are multiples of three</i>

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q3.

<i>A</i>	$(0+10)^*(\varepsilon+1)$	<i>1</i>	<i>Set of all strings over $\{0,1\}$ not containing two consecutive 0's</i>
<i>B</i>	$0(00)^*$	<i>2</i>	<i>Set of all strings over $\{0,1\}$ not containing two consecutive 1's</i>
<i>C</i>	$00(00)^*+0(00)^*$	<i>3</i>	<i>Set of all odd number of 0's</i>
<i>D</i>	$(1+01)^*(\varepsilon+0)$	<i>4</i>	<i>Set of all 0's excluding ε</i>
		<i>5</i>	<i>Set of all 0's which are multiples of three and four</i>
		<i>6</i>	<i>Set of all 0's which are multiples of three</i>

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

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(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q4.

<i>A</i>	$(0+10)^*(\varepsilon+1)$	<i>1</i>	<i>Set of all strings over $\{0,1\}$ not containing two consecutive 0's</i>
<i>B</i>	$(0+10+110)^*(\varepsilon+1+11)$	<i>2</i>	<i>Set of all strings over $\{0,1\}$ not containing two consecutive 1's</i>
<i>C</i>	$(1+01+001)^*(\varepsilon+0+00)$	<i>3</i>	<i>Set of all strings over $\{0,1\}$ not containing three consecutive 1's.</i>
<i>D</i>	$(1+01)^*(\varepsilon+0)$	<i>4</i>	<i>Set of all strings over $\{0,1\}$ not</i>

			<i>containing three consecutive 0's.</i>
		5	<i>Set of all 0's which are multiples of three and four</i>
		6	<i>Set of all 0's which are multiples of three</i>

Answer:

- (i) A → 1, B → 2, C → 3, D → 4*
- (ii) A → 2, B → 3, C → 4, D → 5*
- (iii) A → 3, B → 4, C → 5, D → 6*
- (iv) A → 2, B → 3, C → 4, D → 1*

Q5.

<i>A</i>	$(0+10)^*(\epsilon+1)$	<i>1</i>	<i>Set of all strings over {0,1} not containing two consecutive 0's</i>
<i>B</i>	$(0+10+110)^*(\epsilon+1+11)$	<i>2</i>	<i>Set of all strings over {0,1} not containing two consecutive 1's</i>
<i>C</i>	$[00+11+(01+10)(00+11)^*(01+10)]^*$	<i>3</i>	<i>Set of all strings over {0,1} not containing three consecutive 1's.</i>
<i>D</i>	$(1+01)^*(\epsilon+0)$	<i>4</i>	<i>Set of all strings over {0,1} containing an even number of 0's and an even number of 1's.</i>
		<i>5</i>	<i>Set of all 0's which are multiples of three and four</i>
		<i>6</i>	<i>Set of all 0's which are</i>

			<i>multiples of three</i>
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(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q6.

<i>A</i>	$(11+0)^*(00+1)^*$	<i>1</i>	<i>Set of all strings over $\{0,1\}$ not containing two consecutive 0's</i>
<i>B</i>	$(0+10+110)^*(\epsilon+1+11)$	<i>2</i>	<i>Set of all strings over $\{0,1\}$ where in some head of the string the 1's occur in consecutive pairs and in the tail of the string the 0's occur in consecutive pairs</i>
<i>C</i>	$[00+11+(01+10)(00+11)^*(01+10)]^*$	<i>3</i>	<i>Set of all strings over $\{0,1\}$ not containing three consecutive 1's.</i>
<i>D</i>	$(1+01)^*(\epsilon+0)$	<i>4</i>	<i>Set of all strings over $\{0,1\}$ containing an even number of 0's and an even number of 1's.</i>
		<i>5</i>	<i>Set of all 0's which are multiples of three and four</i>
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Q7.

<i>A</i>	$(11+0)^*(00+1)^*$	<i>1</i>	<i>Set of all strings over $\{0,1\}$ not containing two consecutive 0's</i>
<i>B</i>	$(01+10)^*$	<i>2</i>	<i>Set of all strings over $\{0,1\}$ where in some head of the string the 1's occur in consecutive pairs and in the tail of the string the 0's occur in consecutive pairs</i>
<i>C</i>	$[00+11+(01+10)(00+11)^*(01+10)]^*$	<i>3</i>	<i>Set of all strings over $\{0,1\}$ containing an equal number of 0's and 1's where every prefix has at most one more 0 than 1's or at most one more 1 than 0's.</i>
<i>D</i>	$(1+01)^*(\epsilon+0)$	<i>4</i>	<i>Set of all strings over $\{0,1\}$ containing an even number of 0's and an even number of 1's.</i>
		<i>5</i>	<i>Set of all 0's which are multiples of three and four</i>
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(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q8.

<i>A</i>	$(11+0)^*(00+1)^*$	<i>1</i>	<i>Set of all strings over $\{0,1\}$ ending in 00.</i>
<i>B</i>	$(01+10)^*$	<i>2</i>	<i>Set of all strings over $\{0,1\}$ where in some head of the string the 1's occur in consecutive pairs and in the tail of the string the 0's occur in consecutive pairs</i>
<i>C</i>	$[00+11+(01+10)(00+11)^*(01+10)]^*$	<i>3</i>	<i>Set of all strings over $\{0,1\}$ containing an equal number of 0's and 1's where every prefix has at most one more 0 than 1's or at most one more 1 than 0's.</i>
<i>D</i>	$(0+1)^*00$	<i>4</i>	<i>Set of all strings over $\{0,1\}$ containing an even number of 0's and an even number of 1's.</i>
		<i>5</i>	<i>Set of all 0's which are multiples of three and four</i>
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Q9.

<i>A</i>	$(11+0)^*(00+1)^*$	<i>1</i>	<i>Set of all strings over $\{0,1\}$ not containing two consecutive 0's</i>
<i>B</i>	$(01+10)^*$	<i>2</i>	<i>Set of all strings over $\{0,1\}$ where in some head of the string the 1's occur in consecutive pairs and in the tail of the string the 0's occur in consecutive pairs</i>
<i>C</i>	$(0+1)^*000(0+1)^*$	<i>3</i>	<i>Set of all strings over $\{0,1\}$ containing an equal number of 0's and 1's where every prefix has at most one more 0 than 1's or at most one more 1 than 0's.</i>
<i>D</i>	$(1+01)^*(\epsilon+0)$	<i>4</i>	<i>Set of all strings over $\{0,1\}$ containing three consecutive 0's.</i>
		<i>5</i>	<i>Set of all 0's which are multiples of three and four</i>
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Q10.

<i>A</i>	$(11+0)^*(00+1)^*$	<i>1</i>	<i>Set of all strings over $\{0,1\}$ where every pair of consecutive 0's occurs before any pair of adjacent 1's.</i>
<i>B</i>	$(01+10)^*$	<i>2</i>	<i>Set of all strings over $\{0,1\}$ where in some</i>

			<i>head of the string the 1's occur in consecutive pairs and in the tail of the string the 0's occur in consecutive pairs</i>
<i>C</i>	$(0+1)^*000(0+1)^*$	<i>3</i>	<i>Set of all strings over {0,1} containing an equal number of 0's and 1's where every prefix has at most one more 0 than 1's or at most one more 1 than 0's.</i>
<i>D</i>	$(0+10)^*(1+10)^*$	<i>4</i>	<i>Set of all strings over {0,1} containing three consecutive 0's.</i>
		<i>5</i>	<i>Set of all 0's which are multiples of three and four</i>
		<i>6</i>	<i>Set of all 0's which are multiples of three</i>

Answer:

(i) A → 1, B → 2, C → 3, D → 4

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(iii) A → 3, B → 4, C → 5, D → 6

(iv) A → 2, B → 3, C → 4, D → 1

Q11.

<i>A</i>	$L=(0+1)^*00(0+1)^*00(0+1)^*$ <i>Intersection</i> $(0+1)^*11(0+1)^*11(0+1)^*$ <i>consider the complement of L</i>	<i>1</i>	<i>Set of all strings over {0,1} where every pair of consecutive 0's occurs before any pair of adjacent 1's.</i>
<i>B</i>	$(01+10)^*$	<i>2</i>	<i>Set of all strings over {0,1} containing at most one pair of consecutive 0's and at most one pair of consecutive 1's.</i>
<i>C</i>	$(0+1)^*000(0+1)^*$	<i>3</i>	<i>Set of all strings over {0,1} containing an</i>

			<i>equal number of 0's and 1's where every prefix has at most one more 0 than 1's or at most one more 1 than 0's.</i>
<i>D</i>	$(0+10)^*(1+10)^*$	<i>4</i>	<i>Set of all strings over {0,1} containing three consecutive 0's.</i>
		<i>5</i>	<i>Set of all 0's which are multiples of three and four</i>
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Q12.

<i>A</i>	$0^*(10^*)^*$	<i>1</i>	<i>Set of all strings over {0,1} where every pair of consecutive 0's occurs before any pair of adjacent 1's.</i>
<i>B</i>	$(01+10)^*$	<i>2</i>	$1^*(01^*)^*$
<i>C</i>	<i>The complement of $(0+1)^*000(0+1)^*$</i>	<i>3</i>	<i>Set of all strings over {0,1} containing an equal number of 0's and 1's where every prefix has at most one more 0 than 1's or at most one more 1 than 0's.</i>
<i>D</i>	$(0+10)^*(1+10)^*$	<i>4</i>	$(1+01+001)^*(\epsilon+0+00)$
		<i>5</i>	<i>Set of all 0's which are multiples of three and four</i>
		<i>6</i>	$(000)^*$

Answer:

- (i) A → 1, B → 2, C → 3, D → 4*
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(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q13.

<i>A</i>	$0^*(10^*)^*$	<i>1</i>	$(Ra)^* R$
<i>B</i>	$(01+10)^*$	<i>2</i>	$1^*(01^*)^*$
<i>C</i>	The complement of $(0+1)^*000(0+1)^*$	<i>3</i>	Set of all strings over $\{0,1\}$ containing an equal number of 0's and 1's where every prefix has at most one more 0 than 1's or at most one more 1 than 0's.
<i>D</i>	$R(aR)^*$ where <i>a</i> and <i>R</i> are some regular expressions	<i>4</i>	$(1+01+001)^*(\epsilon+0+00)$
		<i>5</i>	Set of all 0's which are multiples of three and four
		<i>6</i>	$(000)^*$

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

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Q14.

<i>A</i>	$0^*(10^*)^*$	<i>1</i>	$(Ra)^* R$
<i>B</i>	$(r^*s^*)^*****$	<i>2</i>	$1^*(01^*)^*$
<i>C</i>	The complement of $(0+1)^*000(0+1)^*$	<i>3</i>	$(r+s)^*$
<i>D</i>	$R(aR)^*$ where <i>a</i> and <i>R</i> are some regular expressions	<i>4</i>	$(1+01+001)^*(\epsilon+0+00)$
		<i>5</i>	Set of all 0's which are multiples of three and four
		<i>6</i>	$(000)^*$

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

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Q15.

<i>A</i>	$0^*(10^*)^*$	<i>1</i>	$(Ra)^* R$
<i>B</i>	$(r^*s^*)^*****$	<i>2</i>	$1^*(01^*)^*$
<i>C</i>	$(\epsilon\epsilon+R)^*$	<i>3</i>	$(r+s)^*$

<i>D</i>	<i>R (aR)* where a and R are some regular expressions</i>	<i>4</i>	<i>R*</i>
		<i>5</i>	<i>Set of all 0's which are multiples of three and four</i>
		<i>6</i>	<i>(000)*</i>

Answer:

- (i) A → 1, B → 2, C → 3, D → 4*
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Q16.

<i>A</i>	<i>(R*+S*)*RR</i>	<i>1</i>	<i>(Ra)* R</i>
<i>B</i>	<i>(r*s*)****</i>	<i>2</i>	<i>(R+S)*RR</i>
<i>C</i>	<i>(εε+R)*</i>	<i>3</i>	<i>(r+s)*</i>
<i>D</i>	<i>R (aR)* where a and R are some regular expressions</i>	<i>4</i>	<i>R*</i>
		<i>5</i>	<i>Set of all 0's which are multiples of three and four</i>
		<i>6</i>	<i>(000)*</i>

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Q17.

<i>A</i>	<i>(R*+S*)*RR</i>	<i>1</i>	<i>(Ra)* R</i>
<i>B</i>	<i>(R+R+R+R)R</i>	<i>2</i>	<i>(R+S)*RR</i>
<i>C</i>	<i>(εε+R)*</i>	<i>3</i>	<i>RR</i>
<i>D</i>	<i>R (aR)* where a and R are some regular expressions</i>	<i>4</i>	<i>R</i>
		<i>5</i>	<i>Set of all 0's which are multiples of three and four</i>
		<i>6</i>	<i>(000)*</i>

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Q18.

<i>A</i>	$R(S+T)$	<i>1</i>	$(Ra)^* R$
<i>B</i>	$(R+R+R+R)R$	<i>2</i>	$(RS+RT)$
<i>C</i>	$(\epsilon\epsilon+R)^*$	<i>3</i>	RR
<i>D</i>	$R(aR)^*$ where <i>a</i> and <i>R</i> are some regular expressions	<i>4</i>	R
		<i>5</i>	Set of all 0's which are multiples of three and four
		<i>6</i>	$(000)^*$

Answer:

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Q19.

<i>A</i>	$R(S+T)$	<i>1</i>	$RT+ST$
<i>B</i>	$(R+R+R+R)$	<i>2</i>	$RS+RT$
<i>C</i>	$(\epsilon\epsilon+R)^*R$	<i>3</i>	R
<i>D</i>	$(R+S)T$	<i>4</i>	RR
		<i>5</i>	Set of all 0's which are multiples of three and four
		<i>6</i>	$(000)^*$

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
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 (iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q20.

<i>A</i>	$R(S+T)$	<i>1</i>	$RT+ST$
<i>B</i>	$(R+R+R+R)$	<i>2</i>	$RS+RT$
<i>C</i>	$R+S$	<i>3</i>	R
<i>D</i>	$(R+S)T$	<i>4</i>	$S+R$
		<i>5</i>	Set of all 0's which are multiples of three and four

		6	(000)*
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(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q21.

A	$R(S+T)T$	1	$RT+ST$
B	$(R+S)+T$	2	$RST+RTT$
C	$R+S$	3	$(R+S)+T$
D	$(R+S)T$	4	$S+R$
		5	Set of all 0's which are multiples of three and four
		6	(000)*

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q22.

A	$R(S+T)T$	1	$RT+ST$
B	$(R+S)+T$	2	$RST+RTT$
C	$R+S$	3	$(R+S)+T$
D	$(R+S)T$	4	$S+R$
		5	Set of all 0's which are multiples of three and four
		6	(000)*

Answer:

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Q23.

A	$R(S+T)T$	1	$RT+ST$
B	$(R+S)+T$	2	$RST+RTT$
C	$(RS)T$	3	$(R+S)+T$
D	$(R+S)T$	4	$(RS)T$
		5	Set of all 0's which are multiples of

			<i>three and four</i>
		<i>6</i>	<i>(000)*</i>

Answer:

(i) A → 1, B → 2, C → 3, D → 4

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(iii) A → 3, B → 4, C → 5, D → 6

(iv) A → 2, B → 3, C → 4, D → 1

Q24.

<i>A</i>	ϕ^*	<i>1</i>	<i>RT+ST</i>
<i>B</i>	$(R+S)+T$	<i>2</i>	ϵ
<i>C</i>	$(RS)T$	<i>3</i>	$(R+S)+T$
<i>D</i>	$(R+S)T$	<i>4</i>	$(RS)T$
		<i>5</i>	<i>Set of all 0's which are multiples of three and four</i>
		<i>6</i>	<i>(000)*</i>

Answer:

(i) A → 1, B → 2, C → 3, D → 4

(ii) A → 2, B → 3, C → 4, D → 5

(iii) A → 3, B → 4, C → 5, D → 6

(iv) A → 2, B → 3, C → 4, D → 1

Q25.

<i>A</i>	ϕ^*	<i>1</i>	$\phi\phi\phi$
<i>B</i>	$(R+S)+T$	<i>2</i>	ϵ
<i>C</i>	$(RS)T$	<i>3</i>	$(R+S)+T$
<i>D</i>	$\phi\phi^*$	<i>4</i>	$(RS)T$
		<i>5</i>	<i>Set of all 0's which are multiples of three and four</i>
		<i>6</i>	<i>(000)*</i>

Answer:

(i) A → 1, B → 2, C → 3, D → 4

(ii) A → 2, B → 3, C → 4, D → 5

(iii) A → 3, B → 4, C → 5, D → 6

(iv) A → 2, B → 3, C → 4, D → 1

Q26.

<i>A</i>	ϕ^*	<i>1</i>	$\phi\phi\phi$
<i>B</i>	$(R+S)+T$	<i>2</i>	ϵ
<i>C</i>	$R(ST)$	<i>3</i>	$(R+S)+T$
<i>D</i>	$\phi\phi^*$	<i>4</i>	$(RS)T$
		<i>5</i>	<i>Set of all 0's which are multiples of</i>

			<i>three and four</i>
		6	<i>(000)*</i>

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q27.

<i>A</i>	ϕ^*	1	$\phi\phi\phi$
<i>B</i>	$(R+S)+T$	2	ϵ
<i>C</i>	$(00)^*(1+01)$	3	$(R+S)+T$
<i>D</i>	$\phi\phi^*$	4	0^*1
		5	<i>Set of all 0's which are multiples of three and four</i>
		6	<i>(000)*</i>

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q28.

<i>A</i>	ϕ^*	1	$\phi\phi\phi$
<i>B</i>	$((0+1)(0+1)(0+1))^* + ((0+1)(0+1)(0+1)(0+1))^*$	2	ϵ
<i>C</i>	$(RS)T$	3	<i>Set of all strings over {0,1} which are multiples of three or four</i>
<i>D</i>	$\phi\phi^*$	4	$(RS)T$
		5	<i>Set of all 0's which are multiples of three and four</i>
		6	<i>Set of all strings over {0,1} which are multiples of three and</i>

			four
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Answer:

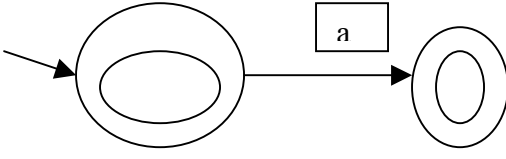
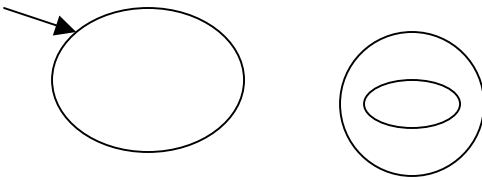
(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q29.

A	ϕ^*	1	$\phi\phi\phi$
B	$((0+1)(0+1)(0+1))^* + ((0+1)(0+1)(0+1)(0+1))^*$	2	ϵ
C	 <p>Consider the set accepted by the finite automata</p>	3	Set of all strings over $\{0,1\}$ which are multiples of three or four
D	 <p>Consider the set accepted by the finite automata</p>	4	$\epsilon\epsilon+a$
		5	Set of all 0's which are multiples of three and four
		6	Set of all strings over $\{0,1\}$ which are multiples of three and four

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q30.

<i>A</i>	<i>Consider the set accepted by the finite automata, M={q}, {0,1}, δ, {q} δ(q,0)=q, δ(q,1)=q</i>	<i>1</i>	<i>φφφ</i>
<i>B</i>	<i>Consider the set accepted by the finite automata, M={q}, {0,1}, δ, {q} δ(q,0)=q, δ(q,1)=φ</i>	<i>2</i>	<i>(0+1)*(0+1)*</i>
<i>C</i>	<i>Consider the set accepted by the finite automata, M={q}, {0,1}, δ, {q} δ(q,0)=φ, δ(q,1)=q</i>	<i>3</i>	<i>0*0*0*</i>
<i>D</i>	<i>(Consider the set accepted by the finite automata, M={q}, {0,1}, δ, {q} δ(q,0)=δ(q,1)=φ</i>	<i>4</i>	<i>1*1*1*</i>
		<i>5</i>	<i>Set of all 0's which are multiples of three and four</i>
		<i>6</i>	<i>(000)*</i>

Answer:

- (i) A → 1, B → 2, C → 3, D → 4*
- (ii) A → 2, B → 3, C → 4, D → 5*
- (iii) A → 3, B → 4, C → 5, D → 6*
- (iv) A → 2, B → 3, C → 4, D → 1*

Q31.

<i>A</i>	<i>Consider the set accepted by the finite automata, M={a,b,c}, {0,1}, δ, {q} δ(a,0)=a, δ(a,1)=b, δ(b,1)=b, δ(b,0)=c, δ(c,0)=c, δ(c,1)=c</i>	<i>1</i>	<i>φφφ</i>
<i>B</i>	<i>Consider the set accepted by the finite automata, M={q}, {0,1}, δ, {q} δ(q,0)=q, δ(q,1)=φ</i>	<i>2</i>	<i>0*0*1*1*</i>
<i>C</i>	<i>Consider the set accepted by the finite automata, M={q}, {0,1}, δ, {q} δ(q,0)=φ, δ(q,1)=q</i>	<i>3</i>	<i>0*0*0*</i>
<i>D</i>	<i>(Consider the set accepted by the finite automata,</i>	<i>4</i>	<i>1*1*1*</i>

	$M = (\{q\}, \{0,1\}, \delta, \{q\})$ $\delta(q,0) = \delta(q,1) = \phi$		
		5	Set of all 0's which are multiples of three and four
		6	(000)*

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q32.

A	Consider the set accepted by the finite automata, $M = (\{q\}, \{0,1\}, \delta, \{q\})$ $\delta(q,0) = q, \delta(q,1) = q$	1	$(01+10)^*$
B	Consider the set accepted by the finite automata, $M = (\{q\}, \{0,1\}, \delta, \{q\})$ $\delta(q,0) = q, \delta(q,1) = \phi$	2	$(0+1)^*(0+1)^*$
C	Consider the set accepted by the finite automata, $M = (\{q\}, \{0,1\}, \delta, \{q\})$ $\delta(q,0) = \phi, \delta(q,1) = q$	3	$0^*0^*0^*$
D	Consider the set accepted by the finite automata, $M = (\{q0, q1, q2, q3\}, \{0,1\}, \delta, \{q\})$ $\delta(q0,0) = q1, \delta(q0,1) = q2,$ $\delta(q1,1) = q0, \delta(q1,0) = q3,$ $\delta(q2,0) = q0, \delta(q2,1) = q3,$ $\delta(q3,0) = q3, \delta(q3,1) = q3$	4	$1^*1^*1^*$
		5	Set of all 0's which are multiples of three and four
		6	(000)*

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q33.

<i>A</i>	Consider the set accepted by the finite automata, $M = (\{q\}, \{0, 1\}, \delta, \{q\})$ $\delta(q, 0) = q, \delta(q, 1) = q$	1	Set of all strings over $\{0, 1\}$ with an equal number of 0's and 1's where every prefix has at most one more 0 than 1 or at most one more 1 than a 0.
<i>B</i>	Consider the set accepted by the finite automata, $M = (\{q\}, \{0, 1\}, \delta, \{q\})$ $\delta(q, 0) = q, \delta(q, 1) = \phi$	2	The set of all strings over $\{0, 1\}$
<i>C</i>	Consider the set accepted by the finite automata, $M = (\{q\}, \{0, 1\}, \delta, \{q\})$ $\delta(q, 0) = \phi, \delta(q, 1) = q$	3	The set of all 0's
<i>D</i>	Consider the set accepted by the finite automata, $M = (\{q_0, q_1, q_2, q_3\}, \{0, 1\}, \delta, \{q\})$ $\delta(q_0, 0) = q_1, \delta(q_0, 1) = q_2,$ $\delta(q_1, 1) = q_0, \delta(q_1, 0) = q_3,$ $\delta(q_2, 0) = q_0, \delta(q_2, 1) = q_3,$ $\delta(q_3, 0) = q_3, \delta(q_3, 1) = q_3$	4	The set of all 1's
		5	Set of all 0's which are multiples of three and four
		6	(000)*

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q34.

<i>A</i>	Consider the regular set denoted by $(1+01+001)^*(\epsilon+0+00)$	1	Set of all strings over $\{0, 1\}$ with an equal number
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			<i>of 0's and 1's where every prefix has at most one more 0 than 1 or at most one more 1 than a 0.</i>
<i>B</i>	<i>Consider the set denoted by $(0+1)^*(00+11)$</i>	<i>2</i>	<i>The minimal finite automata has three states</i>
<i>C</i>	<i>Consider the set accepted by the finite automata, $M=(\{q\},\{0,1\},\delta,\{q\})$ $\delta(q,0)=\phi,\delta(q,1)=q$</i>	<i>3</i>	<i>The minimal finite automata has 5 states</i>
<i>D</i>	<i>Consider the set accepted by the finite automata, $M=(\{q0,q1,q2,q3\},\{0,1\},\delta,\{q\})$ $\delta(q0,0)=q1,\delta(q0,1)=q2,$ $\delta(q1,1)=q0,\delta(q1,0)=q3,$ $\delta(q2,0)=q0,\delta(q2,1)=q3,$ $\delta(q3,0)=q3,\delta(q3,1)=q3$</i>	<i>4</i>	<i>The set of all 1's</i>
		<i>5</i>	<i>Set of all 0's which are multiples of three and four</i>
		<i>6</i>	<i>$(000)^*$</i>

Answer:

(i) A → 1, B → 2, C → 3, D → 4

(ii) A → 2, B → 3, C → 4, D → 5

(iii) A → 3, B → 4, C → 5, D → 6

(iv) A → 2, B → 3, C → 4, D → 1

Q35.

<i>A</i>	<i>Consider the regular set denoted by $(1+01+001)^*(\epsilon+0+00)$</i>	<i>1</i>	<i>The minimal finite automata has four states</i>
<i>B</i>	<i>Consider the set denoted by $(0+1)^*(00+11)$</i>	<i>2</i>	<i>The minimal finite automata has three states</i>
<i>C</i>	<i>Consider the set denoted by the regular expression $(00)^*+(0000)^*+(000000)^*$</i>	<i>3</i>	<i>The minimal finite automata has 5 states</i>
<i>D</i>	<i>Consider the set accepted by the finite automata, $M=(\{q0,q1,q2,q3\},\{0,1\},\delta,\{q\})$</i>	<i>4</i>	<i>The minimal finite automata has two states</i>

	$\delta(q0,0)=q1, \delta(q0,1)=q2,$ $\delta(q1,1)=q0, \delta(q1,0)=q3,$ $\delta(q2,0)=q0, \delta(q2,1)=q3,$ $\delta(q3,0)=q3, \delta(q3,1)=q3$		
		5	Set of all 0's which are multiples of three and four
		6	(000)*

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q36.

A	Consider the regular set denoted by $(0+1)^*1(0+1)(0+1)(0^0)$	1	The minimal finite automata has four states
B	Consider the set denoted by $(0+1)^*(00+11)$	2	The minimal finite automata has 8 states
C	Consider the set denoted by the regular expression $(00)^*+(0000)^*+(000000)^*$	3	The minimal finite automata has 5 states
D	Consider the set accepted by the finite automata, $M=(\{q0, q1, q2, q3\}, \{0, 1\}, \delta, \{q\})$ $\delta(q0,0)=q1, \delta(q0,1)=q2,$ $\delta(q1,1)=q0, \delta(q1,0)=q3,$ $\delta(q2,0)=q0, \delta(q2,1)=q3,$ $\delta(q3,0)=q3, \delta(q3,1)=q3$	4	The minimal finite automata has two states
		5	Set of all 0's which are multiples of three and four
		6	(000)*

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q37.

<i>A</i>	<i>Consider the regular set the set of all strings over {0,1} not containing 1 as a substring</i>	<i>1</i>	<i>The minimal finite automata has 5 states</i>
<i>B</i>	<i>Consider the regular set the set of all strings over {0,1} not containing 11 as a substring</i>	<i>2</i>	<i>The minimal finite automata has 2 states</i>
<i>C</i>	<i>Consider the regular set the set of all strings over {0,1} not containing 111 as a substring</i>	<i>3</i>	<i>The minimal finite automata has 3 states</i>
<i>D</i>	<i>Consider the regular set the set of all strings over {0,1} not containing 1111 as a substring</i>	<i>4</i>	<i>The minimal finite automata has 4 states</i>
		<i>5</i>	<i>Set of all 0's which are multiples of three and four</i>
		<i>6</i>	<i>(000)*</i>

Answer:

- (i) A → 1, B → 2, C → 3, D → 4*
- (ii) A → 2, B → 3, C → 4, D → 5*
- (iii) A → 3, B → 4, C → 5, D → 6*
- (iv) A → 2, B → 3, C → 4, D → 1*

Q38.

<i>A</i>	<i>Consider the regular set the set of all strings over {0,1} not containing 101 as a substring</i>	<i>1</i>	<i>The minimal finite automata has 3 states</i>
<i>B</i>	<i>Consider the regular set the set of all strings over {0,1} starting with a 1 that interpreted as the binary representation of an integer are</i>	<i>2</i>	<i>The minimal finite automata has 4 states</i>

	<i>congruent to 0 modulo 5</i>		
<i>C</i>	<i>Consider the regular set the set of all strings over {0,1} where the 10th symbol from the right end is a 1</i>	<i>3</i>	<i>The minimal finite automata has 7 states</i>
<i>D</i>	<i>Consider the regular set the set of all strings over {0,1} ending in 00</i>	<i>4</i>	<i>The minimal finite automata has 1024 states</i>
		<i>5</i>	<i>tshe minimal finite automata has 1000 states</i>
		<i>6</i>	<i>No minimal finite automata exists</i>

Answer:

(i) A → 1, B → 2, C → 3, D → 4

(ii) A → 2, B → 3, C → 4, D → 5

(iii) A → 3, B → 4, C → 5, D → 6

(iv) A → 2, B → 3, C → 4, D → 1

Q39.

<i>A</i>	<i>Consider the regular set the set of all strings over {0,1} where the 1's are divisible by 10 and the 0's are divisible by 11</i>	<i>1</i>	<i>The minimal finite automata has 5 states</i>
<i>B</i>	<i>Consider the regular set the set of all strings over {0,1} where the 0s's are divisible the 3 and the 1's by 2</i>	<i>2</i>	<i>The minimal automata has 110 states</i>
<i>C</i>	<i>Consider the regular set the set of all strings over {0,1} where the 0's are divisible by 6 and the 1's divisible by 8</i>	<i>3</i>	<i>The minimal finite automata has 6 states</i>
<i>D</i>	<i>Consider the</i>	<i>4</i>	<i>The minimal finite</i>

	<i>regular set the set of all strings over {0,1} not containing 1111 as a substring</i>		<i>automata has 48 states</i>
		<i>5</i>	<i>The minimal finite automata has 89 states</i>
		<i>6</i>	<i>The minimal finite automata has 890 states</i>

Answer:

(i) A → 1, B → 2, C → 3, D → 4

(ii) A → 2, B → 3, C → 4, D → 5

(iii) A → 3, B → 4, C → 5, D → 6

(iv) A → 2, B → 3, C → 4, D → 1

Q40.

<i>A</i>	<i>Consider a deterministic finite automata with input alphabet {0,1} of 10^{1000} states which has no final state</i>	<i>1</i>	<i>The empty string is not accepted</i>
<i>B</i>	<i>Consider a deterministic finite automata with input alphabet {0,1} of 10^{1000} states where all the states are final states</i>	<i>2</i>	<i>The empty set is accepted</i>
<i>C</i>	<i>Consider a deterministic finite automata over the alphabet {0,1} of 10^{1000} states where the start state is the final state</i>	<i>3</i>	<i>$(0+1)^*$ is accepted</i>
<i>D</i>	<i>Consider a deterministic finite automata of 10^{1000} states over the alphabet {0,1} where the start state is not a final state</i>	<i>4</i>	<i>The empty string is accepted</i>

		5	0 is accepted
		6	1 is accepted

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
- (ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
- (iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
- (iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q41.

A	Consider a nondeterministic finite automata with input alphabet $\{0,1\}$ of 10^{1000} states which has no final state	1	The empty string is not accepted
B	Consider a nondeterministic finite automata with input alphabet $\{0,1\}$ of 10^{1000} states where all the states are final states	2	The empty set is accepted
C	Consider a nondeterministic finite automata over the alphabet $\{0,1\}$ of 10^{1000} states where the start state is the final state	3	$(0+1)^*$ is accepted
D	Consider a nondeterministic finite automata of 10^{1000} states over the alphabet $\{0,1\}$ where the start state is not a final state	4	The empty string is accepted
		5	0 is accepted
		6	1 is accepted

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
- (ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
- (iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
- (iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q42.

<i>A</i>	<i>Deterministic finite automata</i>	<i>1</i>	<i>r.e. sets</i>
<i>B</i>	<i>Deterministic push down automata</i>	<i>2</i>	<i>Regular sets</i>
<i>C</i>	<i>Nondeterministic linear bounded auotmata</i>	<i>3</i>	<i>Deterministic context free languages</i>
<i>D</i>	<i>Deterministic turing machines</i>	<i>4</i>	<i>Context sensititve lanaugages</i>
		<i>5</i>	<i>Context free languages</i>
		<i>6</i>	<i>Recursive sets</i>

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q43.

<i>A</i>	<i>Nondeterministic finite automata</i>	<i>1</i>	<i>r.e. sets</i>
<i>B</i>	<i>push down automata</i>	<i>2</i>	<i>Regular sets</i>
<i>C</i>	<i>Nondeterministic linear bounded auotmata</i>	<i>3</i>	<i>context free languages</i>
<i>D</i>	<i>Nondeterministic turing machines</i>	<i>4</i>	<i>Context sensitive lanaugages</i>
		<i>5</i>	<i>Deterministic context free languageslanguages</i>
		<i>6</i>	<i>Recursive sets</i>

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q44.

<i>A</i>	<i>Two way deterministic finite automata</i>	<i>1</i>	<i>r.e. sets</i>
<i>B</i>	<i>Deterministic push down automata</i>	<i>2</i>	<i>Regular sets</i>
<i>C</i>	<i>Nondeterministic linear bounded auotmata</i>	<i>3</i>	<i>Deterministic context free languages</i>
<i>D</i>	<i>Multitape turing</i>	<i>4</i>	<i>Context sensitive</i>

	<i>machines</i>		<i>languages</i>
		5	<i>Context free languages</i>
		6	<i>Recursive sets</i>

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q45.

<i>A</i>	<i>Two way non-deterministic finite automata</i>	<i>1</i>	<i>r.e. sets</i>
<i>B</i>	<i>Deterministic push down automata</i>	<i>2</i>	<i>Regular sets</i>
<i>C</i>	<i>Nondeterministic linear bounded automata</i>	<i>3</i>	<i>Deterministic context free languages</i>
<i>D</i>	<i>Multiheaded turing machines</i>	<i>4</i>	<i>Context sensitive languages</i>
		<i>5</i>	<i>Context free languages</i>
		<i>6</i>	<i>Recursive sets</i>

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q46.

<i>A</i>	<i>Halting Turing pushdown tape machines</i>	<i>1</i>	<i>r.e. sets</i>
<i>B</i>	<i>Deterministic push down automata</i>	<i>2</i>	<i>Recursive sets</i>
<i>C</i>	<i>Nondeterministic linear bounded automata</i>	<i>3</i>	<i>Deterministic context free languages</i>
<i>D</i>	<i>10000 counter machines</i>	<i>4</i>	<i>Context sensitive languages</i>
		<i>5</i>	<i>Context free languages</i>
		<i>6</i>	<i>Regular sets</i>

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
- (ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
- (iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
- (iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q47.

<i>A</i>	<i>Turing machines that have no ink</i>	<i>1</i>	<i>r.e. sets</i>
<i>B</i>	<i>Deterministic push down automata</i>	<i>2</i>	<i>Regular sets</i>
<i>C</i>	<i>Nondeterministic linear bounded automata</i>	<i>3</i>	<i>Deterministic context free languages</i>
<i>D</i>	<i>Deterministic turing machines</i>	<i>4</i>	<i>Context sensitive languages</i>
		<i>5</i>	<i>Context free languages</i>
		<i>6</i>	<i>Recursive sets</i>

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
- (ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
- (iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
- (iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q48.

<i>A</i>	<i>Linear bounded automata that have no ink</i>	<i>1</i>	<i>r.e. sets</i>
<i>B</i>	<i>Deterministic push down automata</i>	<i>2</i>	<i>Regular sets</i>
<i>C</i>	<i>Nondeterministic linear bounded automata</i>	<i>3</i>	<i>Deterministic context free languages</i>
<i>D</i>	<i>Deterministic turing machines</i>	<i>4</i>	<i>Context sensitive languages</i>
		<i>5</i>	<i>Context free languages</i>
		<i>6</i>	<i>Recursive sets</i>

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
- (ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
- (iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
- (iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q49.

<i>A</i>	<i>Push down automata where the stack cannot grow more than some N symbols, N fixed</i>	<i>1</i>	<i>r.e. sets</i>
<i>B</i>	<i>Deterministic push down automata</i>	<i>2</i>	<i>Regular sets</i>
<i>C</i>	<i>Nondeterministic linear bounded automata</i>	<i>3</i>	<i>Deterministic context free languages</i>
<i>D</i>	<i>Deterministic turing machines</i>	<i>4</i>	<i>Context sensitive languages</i>
		<i>5</i>	<i>Context free languages</i>
		<i>6</i>	<i>Recursive sets</i>

Answer:

- (i) A → 1, B → 2, C → 3, D → 4*
- (ii) A → 2, B → 3, C → 4, D → 5*
- (iii) A → 3, B → 4, C → 5, D → 6*
- (iv) A → 2, B → 3, C → 4, D → 1*

Q50.

<i>A</i>	<i>Multidimensional, multitape, multiheaded turing machines with 1098 push down tapes but no ink</i>	<i>1</i>	<i>r.e. sets</i>
<i>B</i>	<i>Deterministic push down automata</i>	<i>2</i>	<i>Regular sets</i>
<i>C</i>	<i>Nondeterministic linear bounded automata</i>	<i>3</i>	<i>Deterministic context free languages</i>
<i>D</i>	<i>Deterministic turing machines</i>	<i>4</i>	<i>Context sensitive languages</i>
		<i>5</i>	<i>Context free languages</i>
		<i>6</i>	<i>Recursive sets</i>

Answer:

- (i) A → 1, B → 2, C → 3, D → 4*
- (ii) A → 2, B → 3, C → 4, D → 5*
- (iii) A → 3, B → 4, C → 5, D → 6*
- (iv) A → 2, B → 3, C → 4, D → 1*

Q51.

<i>A</i>	<i>Deterministic finite automata</i>	<i>1</i>	<i>Recursive sets</i>
<i>B</i>	<i>Deterministic push down</i>	<i>2</i>	<i>Regular sets</i>

	<i>automata</i>		
<i>C</i>	<i>Nondeterministic linear bounded automata</i>	<i>3</i>	<i>Deterministic context free languages</i>
<i>D</i>	<i>Deterministic halting turing machines</i>	<i>4</i>	<i>Context sensitive languages</i>
		<i>5</i>	<i>Context free languages</i>
		<i>6</i>	<i>R.e. sets</i>

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q52.

<i>A</i>	<i>Type 3 grammars</i>	<i>1</i>	<i>r.e. sets</i>
<i>B</i>	<i>LR(k) grammars</i>	<i>2</i>	<i>Regular sets</i>
<i>C</i>	<i>Type 1 grammars</i>	<i>3</i>	<i>Deterministic context free languages</i>
<i>D</i>	<i>Type 0 grammars</i>	<i>4</i>	<i>Context sensitive languages</i>
		<i>5</i>	<i>Context free languages</i>
		<i>6</i>	<i>Recursive sets</i>

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q53.

<i>A</i>	<i>Deterministic finite automata</i>	<i>1</i>	<i>Type 0 languages</i>
<i>B</i>	<i>Deterministic push down automata</i>	<i>2</i>	<i>Type 3 languages</i>
<i>C</i>	<i>Nondeterministic linear bounded automata</i>	<i>3</i>	<i>Deterministic context free languages</i>
<i>D</i>	<i>Deterministic turing machines</i>	<i>4</i>	<i>Type 1 languages</i>
		<i>5</i>	<i>Type 2 languages</i>
		<i>6</i>	<i>Recursive sets</i>

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q54.

<i>A</i>	<i>Deterministic finite automata</i>	<i>1</i>	<i>Procedures that are not necessarily algorithms</i>
<i>B</i>	<i>Deterministic push down automata</i>	<i>2</i>	<i>Regular sets</i>
<i>C</i>	<i>Halting two pushdown tape machines</i>	<i>3</i>	<i>Deterministic context free languages</i>
<i>D</i>	<i>Deterministic turing machines</i>	<i>4</i>	<i>Algorithms</i>
		<i>5</i>	<i>Context free languages</i>
		<i>6</i>	<i>Recursive sets</i>

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q55.

<i>A</i>	<i>The set of all strings over $\{0,1\}$ with any number of 0's and any number of 1's</i>	<i>1</i>	<i>Recursive set that is not context sensitive</i>
<i>B</i>	<i>The set of all strings over $\{0,1\}$ with an equal number of 0's and 1's</i>	<i>2</i>	<i>Regular set but not a dcfl</i>
<i>C</i>	<i>The set of all strings over $\{0,1,2\}$ with an equal number of 0's, 1's and 2's.</i>	<i>3</i>	<i>Deterministic context free language</i>
<i>D</i>	<i>The set of regular expressions whose complement is empty</i>	<i>4</i>	<i>Context sensitive language that is not context free</i>

		5	<i>r.e but not recursive</i>
		6	<i>Finite set</i>

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
- (ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
- (iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
- (iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q56.

<i>A</i>	<i>The set of all strings over {0,1} with any number of 0's and any number of 1's</i>	<i>1</i>	<i>Recursive set that is not context sensitive</i>
<i>B</i>	<i>The set of all palidromes over {0,1}</i>	<i>2</i>	<i>Regular set but not a dcfl</i>
<i>C</i>	<i>The set of all strings over {0,1,2} with an equal number of 0's, 1's and 2's.</i>	<i>3</i>	<i>context free language</i>
<i>D</i>	<i>The set of regular expressions whose complement is empty</i>	<i>4</i>	<i>Context sensitive language that is not context free</i>
		<i>5</i>	<i>r.e but not recursive</i>
		<i>6</i>	<i>Finite set</i>

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
- (ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
- (iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
- (iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q57.

<i>A</i>	<i>The set of all strings over {0,1} with any number of 0's and any number of 1's</i>	<i>1</i>	<i>Recursive set</i>
<i>B</i>	<i>The set of all strings over {0,1} with an equal number of 0's and</i>	<i>2</i>	<i>Regular set but not a dcfl</i>

	<i>1's</i>		
<i>C</i>	<i>The set of all strings over {0,1,2} of the form ww where w is a string in {0,1,2}+</i>	<i>3</i>	<i>Deterministic context free language</i>
<i>D</i>	<i>The set of regular expressions whose complement is empty</i>	<i>4</i>	<i>Context sensitive language that is not context free</i>
		<i>5</i>	<i>r.e but not recursive</i>
		<i>6</i>	<i>Finite set</i>

Answer:

- (i) A → 1, B → 2, C → 3, D → 4*
- (ii) A → 2, B → 3, C → 4, D → 5*
- (iii) A → 3, B → 4, C → 5, D → 6*
- (iv) A → 2, B → 3, C → 4, D → 1*

Q58.

<i>A</i>	<i>The set of all strings over {0,1} with any number of 0's and any number of 1's</i>	<i>1</i>	<i>Recursive set</i>
<i>B</i>	<i>The set of all strings over {0,1} not of the form ww, w in {0,1}+</i>	<i>2</i>	<i>Regular set but not a dcfl</i>
<i>C</i>	<i>The set of all strings over {0,1,2} with an equal number of 0's, 1's and 2's.</i>	<i>3</i>	<i>context free language</i>
<i>D</i>	<i>The set of regular expressions whose intersection is empty</i>	<i>4</i>	<i>Context sensitive language that is not context free</i>
		<i>5</i>	<i>r.e but not recursive</i>
		<i>6</i>	<i>Finite set</i>

Answer:

- (i) A → 1, B → 2, C → 3, D → 4*
- (ii) A → 2, B → 3, C → 4, D → 5*
- (iii) A → 3, B → 4, C → 5, D → 6*

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q59.

<i>A</i>	<i>The set of all strings over {0,1} with any number of 0's and any number of 1's</i>	<i>1</i>	<i>Recursive set</i>
<i>B</i>	<i>The set of all strings over {0,1} with an unequal number of 0's and 1's</i>	<i>2</i>	<i>Regular set but not a dcfl</i>
<i>C</i>	<i>The set of all strings over {0,1,2} with an equal number of 0's, 1's and 2's.</i>	<i>3</i>	<i>context free language</i>
<i>D</i>	<i>The set of regular expressions whose complement is empty</i>	<i>4</i>	<i>Context sensitive language that is not context free</i>
		<i>5</i>	<i>r.e but not recursive</i>
		<i>6</i>	<i>Finite set</i>

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q61.

<i>A</i>	<i>The set of all strings over {0,1} not containing three consecutive 0's and not containing three consecutive 1's.</i>	<i>1</i>	<i>Recursive set</i>
<i>B</i>	<i>The set of all strings over {0,1,2} with an unequal number of 0's and 1's or an unequal number of 1's and 2's</i>	<i>2</i>	<i>Regular set but not a dcfl</i>
<i>C</i>	<i>The set of all</i>	<i>3</i>	<i>context free</i>

	<i>strings primes in unary.</i>		<i>language</i>
<i>D</i>	<i>The set of regular expressions whose complement is empty</i>	<i>4</i>	<i>Context sensitive language that is not context free</i>
		<i>5</i>	<i>r.e but not recursive</i>
		<i>6</i>	<i>Finite set</i>

Answer:

- (i) A → 1, B → 2, C → 3, D → 4*
- (ii) A → 2, B → 3, C → 4, D → 5*
- (iii) A → 3, B → 4, C → 5, D → 6*
- (iv) A → 2, B → 3, C → 4, D → 1*

Q62.

<i>A</i>	<i>The set of all powers of 2 in binary</i>	<i>1</i>	<i>Recursive set</i>
<i>B</i>	<i>The set of all strings palidromes over a finite alphabet</i>	<i>2</i>	<i>Regular set but not a dcfl</i>
<i>C</i>	<i>The set of all strings primes in unary.</i>	<i>3</i>	<i>context free language</i>
<i>D</i>	<i>The set of regular expressions whose complement is empty</i>	<i>4</i>	<i>Context sensitive language that is not context free</i>
		<i>5</i>	<i>r.e but not recursive</i>
		<i>6</i>	<i>Finite set</i>

Answer:

- (i) A → 1, B → 2, C → 3, D → 4*
- (ii) A → 2, B → 3, C → 4, D → 5*
- (iii) A → 3, B → 4, C → 5, D → 6*
- (iv) A → 2, B → 3, C → 4, D → 1*

Q63.

<i>A</i>	<i>The set of all powers of 2 in binary</i>	<i>1</i>	<i>Recursive set</i>
<i>B</i>	<i>The set of all</i>	<i>2</i>	<i>Regular set but not</i>

	<i>strings with an equal number of 0's and 1's or with twice as many 0's as 1's.</i>		<i>a dcfl</i>
<i>C</i>	<i>The set of all strings that are not primes in binary.</i>	<i>3</i>	<i>context free language</i>
<i>D</i>	<i>The set of regular expressions whose complement is empty</i>	<i>4</i>	<i>Context sensitive language that is not context free</i>
		<i>5</i>	<i>r.e but not recursive</i>
		<i>6</i>	<i>Finite set</i>

Answer:

- (i) A → 1, B → 2, C → 3, D → 4*
- (ii) A → 2, B → 3, C → 4, D → 5*
- (iii) A → 3, B → 4, C → 5, D → 6*
- (iv) A → 2, B → 3, C → 4, D → 1*

Q64.

<i>A</i>	<i>The set of all powers of 20 in base 20</i>	<i>1</i>	<i>Recursive set</i>
<i>B</i>	<i>$\{0^m 1^n 0^{(m+n)} \mid m, n > 1\}$</i>	<i>2</i>	<i>Regular set but not a dcfl</i>
<i>C</i>	<i>The set of all strings primes in unary.</i>	<i>3</i>	<i>context free language</i>
<i>D</i>	<i>The set of regular expressions whose complement is empty</i>	<i>4</i>	<i>Context sensitive language that is not context free</i>
		<i>5</i>	<i>r.e but not recursive</i>
		<i>6</i>	<i>Finite set</i>

Answer:

- (i) A → 1, B → 2, C → 3, D → 4*
- (ii) A → 2, B → 3, C → 4, D → 5*
- (iii) A → 3, B → 4, C → 5, D → 6*
- (iv) A → 2, B → 3, C → 4, D → 1*

Q65.

<i>A</i>	<i>The set of all powers of 20 in base 20</i>	<i>1</i>	<i>Recursive set</i>
<i>B</i>	<i>$\{0^m 1^n 0^{(m+n)} \mid m, n > 1\}$</i>	<i>2</i>	<i>Regular set but</i>

			<i>not a dcfl</i>
<i>C</i>	$\{wwRw w \text{ in } \{0,1\}^+\}$	<i>3</i>	<i>context free language</i>
<i>D</i>	<i>The set of regular expressions whose complement is empty</i>	<i>4</i>	<i>Context sensitive language that is not context free</i>
		<i>5</i>	<i>r.e but not recursive</i>
		<i>6</i>	<i>Finite set</i>

Answer:

(i) A → 1, B → 2, C → 3, D → 4

(ii) A → 2, B → 3, C → 4, D → 5

(iii) A → 3, B → 4, C → 5, D → 6

(iv) A → 2, B → 3, C → 4, D → 1

Q66.

<i>A</i>	<i>The set of all powers of 20 in base 20</i>	<i>1</i>	<i>Recursive set</i>
<i>B</i>	$\{0^m 1^n 0^{m+n} m, n > 1\}$	<i>2</i>	<i>Regular set but not a dcfl</i>
<i>C</i>	$\{a^n b^n n > 1\}$	<i>3</i>	<i>context free language</i>
<i>D</i>	<i>The set of regular expressions whose complement is empty</i>	<i>4</i>	<i>Context sensitive language that is not context free</i>
		<i>5</i>	<i>r.e but not recursive</i>
		<i>6</i>	<i>Finite set</i>

Answer:

(i) A → 1, B → 2, C → 3, D → 4

(ii) A → 2, B → 3, C → 4, D → 5

(iii) A → 3, B → 4, C → 5, D → 6

(iv) A → 2, B → 3, C → 4, D → 1

Q67.

<i>A</i>	<i>The set of all powers of 20 in base 20</i>	<i>1</i>	<i>Recursive set</i>
<i>B</i>	$\{0^m 1^n 0^{m+n} m, n > 1\}$	<i>2</i>	<i>Regular set but not a dcfl</i>
<i>C</i>	$\{a^i b^j \gcd(i, j) = 1\}$	<i>3</i>	<i>context free language</i>
<i>D</i>	<i>The set of regular expressions</i>	<i>4</i>	<i>Context</i>

	<i>whose complement is empty</i>		<i>sensitive language that is not context free</i>
		5	<i>r.e but not recursive</i>
		6	<i>Finite set</i>

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q68.

<i>A</i>	<i>The set of all powers of 200 in base 200</i>	1	<i>Recursive set</i>
<i>B</i>	$\{0^m 1^n \mid m, n > 1\}$	2	<i>Regular set but not a dcfl</i>
<i>C</i>	$\{a^i b^j c^k \mid i \text{ not equal to } j \text{ not equal to } k\}$	3	<i>context free language</i>
<i>D</i>	<i>The set of regular expressions whose complement is empty</i>	4	<i>Context sensitive language that is not context free</i>
		5	<i>r.e but not recursive</i>
		6	<i>Finite set</i>

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q69.

<i>A</i>	<i>The set of all strings over $\{0,1\}$ not containing 0000000001111111100000 as a substring</i>	1	<i>Finite set</i>
<i>B</i>	$\{0^m 1^n \mid m, n > 1\}$	2	<i>Regular set but not a dcfl</i>
<i>C</i>	$\{a^i b^j c^k \mid i \text{ not equal to } j \text{ not equal to } k\}$	3	<i>context free language</i>
<i>D</i>	$\{0^n 1^n \mid n < 20 \text{ lakh}\}$	4	<i>Context sensitive language that is</i>

			<i>not context free</i>
		5	<i>r.e but not recursive</i>
		6	<i>Recursive set not necessarily a context sensitive language</i>

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q70.

<i>A</i>	$S \rightarrow a aS b bS$	1	<i>Finite set</i>
<i>B</i>	$S \rightarrow aSb ab$	2	<i>Regular set but not a dcfl</i>
<i>C</i>	$\{a^i b^j c^k i \text{ not equal to } j \text{ not equal to } k\}$	3	<i>context free language</i>
<i>D</i>	$\{0^n 1^n n < 2000000 \text{ lakh}\}$	4	<i>Context sensitive language that is not context free</i>
		5	<i>r.e but not recursive</i>
		6	<i>Recursive set not necessarily a context sensitive language</i>

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q71.

<i>A</i>	$S \rightarrow a aS b bS$	1	<i>Finite set</i>
<i>B</i>	$S \rightarrow aSa bSb a b$	2	<i>Regular set but not a dcfl</i>
<i>C</i>	$\{a^i b^j c^k i \text{ not equal to } j \text{ not equal to } k\}$	3	<i>context free language</i>
<i>D</i>	$\{0^n 1^n n < 2000000 \text{ lakh}\}$	4	<i>Context sensitive language that is not context free</i>
		5	<i>r.e but not</i>

			<i>recursive</i>
		6	<i>Recursive set not necessarily a context sensitive language</i>

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q72.

<i>A</i>	$S \rightarrow a aS b bS$	1	<i>Finite set</i>
<i>B</i>	$S \rightarrow aSa bSb a b$	2	<i>Regular set but not a dcfl</i>
<i>C</i>	$S \rightarrow aSBC aBC$ $CB \rightarrow BC$ $aB \rightarrow ab$ $bB \rightarrow bb$ $bC \rightarrow bc$ $cC \rightarrow cc$	3	<i>context free language</i>
<i>D</i>	$S \rightarrow a b c d$	4	<i>Context sensitive language that is not context free</i>
		5	<i>r.e but not recursive</i>
		6	<i>Recursive set not necessarily a context sensitive language</i>

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q73.

<i>A</i>	$S \rightarrow a aS b bS$	1	<i>Finite set</i>
<i>B</i>	$S \rightarrow aSa bSb a b$	2	<i>Regular set but not a dcfl</i>
<i>C</i>	$S \rightarrow aSBC aBC$ $CB \rightarrow BC$ $aB \rightarrow ab$ $bB \rightarrow bb$ $bC \rightarrow bc$	3	<i>context free language</i>

	$cC \rightarrow cc$		
<i>D</i>	$S \rightarrow a b c d$	4	The set $\{a^n b^n c^n n \geq 1\}$
		5	r.e but not recursive
		6	Recursive set not necessarily a context sensitive language

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q74.

<i>A</i>	$S \rightarrow a aS b bS$	1	The set of all powers of two unary
<i>B</i>	$S \rightarrow aSa bSb a b$	2	Regular set but not a dcfl
<i>C</i>	$S \rightarrow aSBC aBC$ $CB \rightarrow BC$ $aB \rightarrow ab$ $bB \rightarrow bb$ $bC \rightarrow bc$ $cC \rightarrow cc$	3	context free language
<i>D</i>	$S \rightarrow CWaD$ $Wa \rightarrow aaW$ $WD \rightarrow EW$ $aE \rightarrow Ea$ $CE \rightarrow CW$ $WD \rightarrow FW$ $aFW \rightarrow Fwa$ $CFW \rightarrow \epsilon$	4	The set $\{a^n b^n c^n n \geq 1\}$
		5	r.e but not recursive
		6	Recursive set not necessarily a context sensitive language

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q75.

<i>A</i>	$S \rightarrow a aS b bS$	1	Unrestricted grammar
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<i>B</i>	$S \rightarrow aSa bSb a b$	2	<i>Regular grammar</i>
<i>C</i>	$S \rightarrow aSBC aBC$ $CB \rightarrow BC$ $aB \rightarrow ab$ $bB \rightarrow bb$ $bC \rightarrow bc$ $cC \rightarrow cc$	3	<i>Context free grammar</i>
<i>D</i>	$S \rightarrow CWaD$ $Wa \rightarrow aaW$ $WD \rightarrow EW$ $aE \rightarrow Ea$ $CE \rightarrow CW$ $WD \rightarrow FW$ $aFW \rightarrow Fwa$ $CFW \rightarrow \epsilon$	4	<i>Context sensitive grammar</i>
		5	<i>r.e but not recursive</i>
		6	<i>Recursive set not necessarily a context sensitive language</i>

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
- (ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
- (iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
- (iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q76.

<i>A</i>	$S \rightarrow a aS b bS$	1	<i>Type 0</i>
<i>B</i>	$S \rightarrow aSa bSb a b$	2	<i>Type 3</i>
<i>C</i>	$S \rightarrow aSBC aBC$ $CB \rightarrow BC$ $aB \rightarrow ab$ $bB \rightarrow bb$ $bC \rightarrow bc$ $cC \rightarrow cc$	3	<i>Type 2</i>
<i>D</i>	$S \rightarrow CWaD$ $Wa \rightarrow aaW$ $WD \rightarrow EW$ $aE \rightarrow Ea$ $CE \rightarrow CW$ $WD \rightarrow FW$ $aFW \rightarrow Fwa$ $CFW \rightarrow \epsilon$	4	<i>Type 1</i>
		5	<i>r.e but not</i>

			<i>recursive</i>
		6	<i>Type 4</i>

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q77.

<i>A</i>	<i>All C programs</i>	<i>1</i>	<i>Unrestricted grammar</i>
<i>B</i>	$S \rightarrow aSa bSb a b$	<i>2</i>	<i>Procedures</i>
<i>C</i>	$S \rightarrow aSBC aBC$ $CB \rightarrow BC$ $aB \rightarrow ab$ $bB \rightarrow bb$ $bC \rightarrow bc$ $cC \rightarrow cc$	<i>3</i>	<i>Context free grammar</i>
<i>D</i>	$S \rightarrow CWaD$ $Wa \rightarrow aaW$ $WD \rightarrow EW$ $aE \rightarrow Ea$ $CE \rightarrow CW$ $WD \rightarrow FW$ $aFW \rightarrow Fwa$ $CFW \rightarrow \epsilon$	<i>4</i>	<i>Context sensitive grammar</i>
		<i>5</i>	<i>Not r.e.</i>
		<i>6</i>	<i>Recursive set not necessarily a context sensitive language</i>

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q78.

<i>A</i>	<i>Halting C and Java programs</i>	<i>1</i>	<i>Unrestricted grammar</i>
<i>B</i>	$S \rightarrow aSa bSb a b$	<i>2</i>	<i>Algorithms</i>
<i>C</i>	$S \rightarrow aSBC aBC$ $CB \rightarrow BC$ $aB \rightarrow ab$	<i>3</i>	<i>Context free grammar</i>

	$bB \rightarrow bb$ $bC \rightarrow bc$ $cC \rightarrow cc$		
<i>D</i>	$S \rightarrow CWaD$ $Wa \rightarrow aaW$ $WD \rightarrow EW$ $aE \rightarrow Ea$ $CE \rightarrow CW$ $WD \rightarrow FW$ $aFW \rightarrow Fwa$ $CFW \rightarrow \epsilon$	4	<i>Context sensitive grammar</i>
		5	<i>r.e but not recursive</i>
		6	<i>Recursive set not necessarily a context sensitive language</i>

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q79.

<i>A</i>	<i>r.e. sets</i>	1	<i>Closed under complement but not under union or intersection</i>
<i>B</i>	<i>Recursive sets</i>	2	<i>Not closed under complement but closed under union and intersection</i>
<i>C</i>	<i>Context free languages</i>	3	<i>Closed under union, intersection and complement</i>
<i>D</i>	<i>Deterministic context free languages</i>	4	<i>Closed under union and intersection but not under complement</i>
		5	<i>Not closed under union but closed under intersection</i>
		6	<i>Not closed under union or complement</i>

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q80.

<i>A</i>	<i>r.e. sets</i>	<i>1</i>	<i>Closed under complement but not under union or intersection</i>
<i>B</i>	<i>Regular sets</i>	<i>2</i>	<i>Not closed under complement but closed under union and intersection</i>
<i>C</i>	<i>Context free languages</i>	<i>3</i>	<i>Closed under union, intersection and complement</i>
<i>D</i>	<i>Deterministic context free languages</i>	<i>4</i>	<i>Closed under union and intersection but not under complement</i>
		<i>5</i>	<i>Not closed under union but closed under intersection</i>
		<i>6</i>	<i>Not closed under union or complement</i>

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q81.

<i>A</i>	<i>Finite sets</i>	<i>1</i>	<i>Closed under complement but not under union or intersection</i>
<i>B</i>	<i>Recursive sets</i>	<i>2</i>	<i>Not closed under complement but closed under union and intersection</i>
<i>C</i>	<i>Context free languages</i>	<i>3</i>	<i>Closed under union, intersection</i>

			<i>and complement</i>
<i>D</i>	<i>Deterministic context free languages</i>	<i>4</i>	<i>Closed under union and intersection but not under complement</i>
		<i>5</i>	<i>Not closed under union but closed under intersection</i>
		<i>6</i>	<i>Not closed under union or complement</i>

Answer:

(i) A → 1, B → 2, C → 3, D → 4

(ii) A → 2, B → 3, C → 4, D → 5

(iii) A → 3, B → 4, C → 5, D → 6

(iv) A → 2, B → 3, C → 4, D → 1

Q82.

<i>A</i>	<i>The clique problem</i>	<i>1</i>	<i>Decidable</i>
<i>B</i>	<i>The 2-CNF problem</i>	<i>2</i>	<i>NP-complete</i>
<i>C</i>	<i>The equivalence of context-free languages</i>	<i>3</i>	<i>Is in P</i>
<i>D</i>	<i>Equivalence of finite automata</i>	<i>4</i>	<i>Undecidable</i>
		<i>5</i>	<i>Not closed under union but closed under intersection</i>
		<i>6</i>	<i>Not closed under union or complement</i>

Answer:

(i) A → 1, B → 2, C → 3, D → 4

(ii) A → 2, B → 3, C → 4, D → 5

(iii) A → 3, B → 4, C → 5, D → 6

(iv) A → 2, B → 3, C → 4, D → 1

Q83.

<i>A</i>	<i>The Hamiltonian circuit problem</i>	<i>1</i>	<i>Decidable</i>
<i>B</i>	<i>The 2-CNF problem</i>	<i>2</i>	<i>NP-complete</i>
<i>C</i>	<i>The equivalence of</i>	<i>3</i>	<i>Is in P</i>

	<i>a context-free to Σ^* where Σ is the input vocabulary.</i>		
<i>D</i>	<i>The membership problem of context sensitive languages</i>	<i>4</i>	<i>Undecidable</i>
		<i>5</i>	<i>Not closed under union but closed under intersection</i>
		<i>6</i>	<i>Not closed under union or complement</i>

Answer:

- (i) A → 1, B → 2, C → 3, D → 4*
- (ii) A → 2, B → 3, C → 4, D → 5*
- (iii) A → 3, B → 4, C → 5, D → 6*
- (iv) A → 2, B → 3, C → 4, D → 1*

Q84.

<i>A</i>	<i>The knapsack problem</i>	<i>1</i>	<i>Decidable</i>
<i>B</i>	<i>The 2-CNF problem</i>	<i>2</i>	<i>NP-complete</i>
<i>C</i>	<i>The equivalence of two deterministic turing machines</i>	<i>3</i>	<i>Is in P</i>
<i>D</i>	<i>Whether a context free language is finite, infinite or empty</i>	<i>4</i>	<i>Undecidable</i>
		<i>5</i>	<i>Not closed under union but closed under intersection</i>
		<i>6</i>	<i>Not closed under union or complement</i>

Answer:

- (i) A → 1, B → 2, C → 3, D → 4*
- (ii) A → 2, B → 3, C → 4, D → 5*
- (iii) A → 3, B → 4, C → 5, D → 6*
- (iv) A → 2, B → 3, C → 4, D → 1*

Q85.

<i>A</i>	<i>The graph coloring</i>	<i>1</i>	<i>Decidable</i>
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	<i>problem</i>		
<i>B</i>	<i>The 2-CNF problem</i>	<i>2</i>	<i>NP-complete</i>
<i>C</i>	<i>The Post Correspondence problem</i>	<i>3</i>	<i>Is in P</i>
<i>D</i>	<i>PCP over a single alphabet</i>	<i>4</i>	<i>Undecidable</i>
		<i>5</i>	<i>Not closed under union but closed under intersection</i>
		<i>6</i>	<i>Not closed under union or complement</i>

Answer:

- (i) A → 1, B → 2, C → 3, D → 4*
- (ii) A → 2, B → 3, C → 4, D → 5*
- (iii) A → 3, B → 4, C → 5, D → 6*
- (iv) A → 2, B → 3, C → 4, D → 1*

Q86

<i>A</i>	<i>All formal languages</i>	<i>1</i>	<i>Decidable</i>
<i>B</i>	<i>The class of regular sets</i>	<i>2</i>	<i>Are uncountable</i>
<i>C</i>	<i>Whether a turing machine will halt on blank tape</i>	<i>3</i>	<i>Countably infinite</i>
<i>D</i>	<i>Whether a turing machine will ever leave an input region</i>	<i>4</i>	<i>Undecidable</i>
		<i>5</i>	<i>Not closed under union but closed under intersection</i>
		<i>6</i>	<i>Not closed under union or complement</i>

Answer:

- (i) A → 1, B → 2, C → 3, D → 4*
- (ii) A → 2, B → 3, C → 4, D → 5*
- (iii) A → 3, B → 4, C → 5, D → 6*
- (iv) A → 2, B → 3, C → 4, D → 1*

Q87.

<i>A</i>	$\{w\$w \mid w \text{ in } (0+1)^*\}$	<i>1</i>	<i>Finite set</i>
<i>B</i>	$\{wwR \mid w \text{ in } (0+1)^*\}$	<i>2</i>	<i>Deterministic context free language</i>
<i>C</i>	$\{wwwwwwwR \mid w \text{ in } (0+1)^+\}$	<i>3</i>	<i>Context free language that is not deterministic</i>
<i>D</i>	<i>The set of all strings not containing 0000000000001111000 over $\{0,1\}$ of length less than 10^{100000}</i>	<i>4</i>	<i>Context sensitive language that is not context free</i>
		<i>5</i>	<i>Not closed under union but closed under intersection</i>
		<i>6</i>	<i>Not closed under union or complement</i>

Answer:

(i) A → 1, B → 2, C → 3, D → 4

(ii) A → 2, B → 3, C → 4, D → 5

(iii) A → 3, B → 4, C → 5, D → 6

(iv) A → 2, B → 3, C → 4, D → 1

Q88

<i>A</i>	$\{0^{100n} 1^{1000n} \mid n \geq 1\}$	<i>1</i>	<i>Finite set</i>
<i>B</i>	$\{0^n 1^n \mid n \geq 1 \text{ and } 1^{2n} \mid n \geq 1\}$	<i>2</i>	<i>Deterministic context free language</i>
<i>C</i>	$\{wwwwwwwR \mid w \text{ in } (0+1)^+\}$	<i>3</i>	<i>Context free language that is not deterministic</i>
<i>D</i>	<i>The set of all strings not containing 0000000000001111000 over $\{0,1\}$ of length less than 10^{100000}</i>	<i>4</i>	<i>Context sensitive language that is not context free</i>
		<i>5</i>	<i>Not closed under union but closed under intersection</i>
		<i>6</i>	<i>Not closed under union or complement</i>

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
- (ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
- (iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
- (iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q89

<i>A</i>	$\{ww \mid w \text{ in } (0+1)^*\}$	<i>1</i>	<i>The complement is not a finite set but the set is finite</i>
<i>B</i>	$\{wR \mid R \text{ in } (0+1)^*\}$	<i>2</i>	<i>The complement is a cfl</i>
<i>C</i>	$\{w\$w \mid n(0+1)^+\}$	<i>3</i>	<i>The complement is not a cfl</i>
<i>D</i>	<i>The set of all strings not containing 0000000000001111000 over $\{0,1\}$ of length less than 10^{100000}</i>	<i>4</i>	<i>The complement is a dcfl</i>
		<i>5</i>	<i>Recursive but not a csl</i>
		<i>6</i>	<i>r.e but not recursive</i>

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
- (ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
- (iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
- (iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q90.

<i>A</i>	$S \rightarrow a$	<i>1</i>	<i>The language generated is ambiguous with an infinite number of derivations for a</i>
<i>B</i>	$S \rightarrow a$ $S \rightarrow A$ $A \rightarrow a$	<i>2</i>	<i>The language generated is unambiguous</i>
<i>C</i>	$S \rightarrow a$ $S \rightarrow A B$ $A \rightarrow a$ $B \rightarrow b$	<i>3</i>	<i>The language generated is ambiguous with two derivations for a</i>
<i>D</i>	$S \rightarrow SS a \epsilon$	<i>4</i>	<i>The language generated is ambiguous with three distinct</i>

			<i>derivations for a</i>
		5	<i>The language generated is inherently ambiguous</i>
		6	<i>The language generated is r.e but not recursive</i>

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q91.

<i>A</i>	$E \rightarrow E+E E * E (E) i$	1	<i>The language generated is ambiguous with an infinite number of derivations for a</i>
<i>B</i>	$S \rightarrow a$ $S \rightarrow A$ $A \rightarrow a$	2	<i>The language generated is ambiguous and is the set of all C expressions over + and *</i>
<i>C</i>	$S \rightarrow a$ $S \rightarrow A B$ $A \rightarrow a$ $B \rightarrow b$	3	<i>The language generated is ambiguous with two derivations for a</i>
<i>D</i>	$S \rightarrow SS a \epsilon$	4	<i>The language generated is ambiguous with three distinct derivations for a</i>
		5	<i>The language generated is inherently ambiguous</i>
		6	<i>The language generated is r.e but not recursive</i>

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q92.

A	$E \rightarrow E+E E * E (E) i$	1	The language generated is ambiguous with an infinite number of derivations for a
B	$E \rightarrow E+E E.E (E) a b \epsilon \phi$	2	The language generated is ambiguous and is the set of all C expressions over + and *
C	$S \rightarrow a$ $S \rightarrow A B$ $A \rightarrow a$ $B \rightarrow b$	3	The language generated is ambiguous and is the set of all regular expressions over {a,b}
D	$S \rightarrow SS a \epsilon$	4	The language generated is ambiguous with three distinct derivations for a
		5	The language generated is inherently ambiguous
		6	The language generated is r.e but not recursive

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q93.

<i>A</i>	$E \rightarrow E+E E^*E (E) i$	<i>1</i>	<i>The language generated is ambiguous with an infinite number of derivations for a</i>
<i>B</i>	$E \rightarrow E+E E.E (E) a b \epsilon \phi$	<i>2</i>	<i>The language generated is ambiguous and is the set of all C expressions over + and *</i>
<i>C</i>	$E \rightarrow E+T T$ $T \rightarrow T^*F F$ $F \rightarrow (E) i$	<i>3</i>	<i>The language generated is an unambiguous grammar for arithmetic expressions</i>
<i>D</i>	$S \rightarrow SS a \epsilon$	<i>4</i>	<i>The language generated is ambiguous with three distinct derivations for a</i>
		<i>5</i>	<i>The language generated is inherently ambiguous</i>
		<i>6</i>	<i>The language generated is r.e but not recursive</i>

Answer:

(i) A → 1, B → 2, C → 3, D → 4

(ii) A → 2, B → 3, C → 4, D → 5

(iii) A → 3, B → 4, C → 5, D → 6

(iv) A → 2, B → 3, C → 4, D → 1

Q94.

<i>A</i>	$E \rightarrow E+E E^*E (E) i$	<i>1</i>	<i>The language generated is all strings over {a,b} not of the form ww</i>
<i>B</i>	$E \rightarrow E+E E.E (E) a b \epsilon \phi$	<i>2</i>	<i>The language generated is ambiguous and</i>

			<i>is the set of all C expressions over + and *</i>
<i>C</i>	$E \rightarrow E+T T$ $T \rightarrow T^*F F$ $F \rightarrow (E) i$	<i>3</i>	<i>The language generated is an unambiguous grammar for arithmetic expressions</i>
<i>D</i>	$S \rightarrow AB BA$ $A \rightarrow aAa aAb bAa bAb a$ $B \rightarrow aBa aBb bBa bBb b$ $S \rightarrow SI$ $SI \rightarrow aaSI abSI baSI bbSI a b$	<i>4</i>	<i>The language generated is ambiguous with three distinct derivations for a</i>
		<i>5</i>	<i>The language generated is inherently ambiguous</i>
		<i>6</i>	<i>The language generated is r.e but not recursive</i>

Answer:

(i) A → 1, B → 2, C → 3, D → 4

(ii) A → 2, B → 3, C → 4, D → 5

(iii) A → 3, B → 4, C → 5, D → 6

(iv) A → 2, B → 3, C → 4, D → 1

Q95.

<i>A</i>	$E \rightarrow E+E E^*E (E) i$	<i>1</i>	<i>The language generated is ambiguous and is the set of all strings over {a,b} with an equal number of a's and b's.</i>
<i>B</i>	$E \rightarrow E+E E.E (E) a b \epsilon \phi$	<i>2</i>	<i>The language generated is ambiguous and is the set of all C expressions over + and *</i>
<i>C</i>	$E \rightarrow E+T T$ $T \rightarrow T^*F F$	<i>3</i>	<i>The language generated is an</i>

	$F \rightarrow (E) i$		<i>unambiguous grammar for arithmetic expressions</i>
<i>D</i>	$S \rightarrow aSbS bSaS \epsilon$	<i>4</i>	<i>The language generated is ambiguous with three distinct derivations for a</i>
		<i>5</i>	<i>The language generated is inherently ambiguous</i>
		<i>6</i>	<i>The language generated is r.e but not recursive</i>

Answer:

(i) A → 1, B → 2, C → 3, D → 4

(ii) A → 2, B → 3, C → 4, D → 5

(iii) A → 3, B → 4, C → 5, D → 6

(iv) A → 2, B → 3, C → 4, D → 1

Q96.

<i>A</i>	$E \rightarrow E+E E * E (E) i$	<i>1</i>	<i>The language generated is ambiguous and is the set of all strings over {a,b} with twice as many a's as b's.</i>
<i>B</i>	$E \rightarrow E+E E.E (E) a b \epsilon \phi$	<i>2</i>	<i>The language generated is ambiguous and is the set of all C expressions over + and *</i>
<i>C</i>	$E \rightarrow E+T T$ $T \rightarrow T * F F$ $F \rightarrow (E) i$	<i>3</i>	<i>The language generated is an unambiguous grammar for arithmetic expressions</i>
<i>D</i>	$S \rightarrow aSbSaS aSaSbS bSaSaS \epsilon$	<i>4</i>	<i>The language generated is ambiguous with</i>

			<i>three distinct derivations for a</i>
		5	<i>The language generated is inherently ambiguous</i>
		6	<i>The language generated is r.e but not recursive</i>

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q97.

<i>A</i>	$A \rightarrow aAb ab$ $Al \rightarrow a a Al$ $S \rightarrow Al Al S \epsilon$	<i>1</i>	<i>The language generated is ambiguous and is the set of all strings over {a,b} with twice as many a's as b's.</i>
<i>B</i>	$E \rightarrow E+E E.E (E) a b \epsilon \phi$	<i>2</i>	<i>The language generated is the set of all strings over {a,b} with the a's greater than the b's.</i>
<i>C</i>	$E \rightarrow E+T T$ $T \rightarrow T*F F$ $F \rightarrow (E) i$	<i>3</i>	<i>The language generated is an unambiguous grammar for arithmetic expressions</i>
<i>D</i>	$S \rightarrow aSbSaS aSaSbS bSaSaS \epsilon$	<i>4</i>	<i>The language generated is ambiguous with three distinct derivations for a</i>
		<i>5</i>	<i>The language generated is inherently ambiguous</i>
		<i>6</i>	<i>The language</i>

			<i>generated is r.e but not recursive</i>
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Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
- (ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
- (iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
- (iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q98.

<i>A</i>	$S \rightarrow A1 \mid A \mid A B1 \mid \epsilon \mid A1 \mid B1$ $A \rightarrow aAb \mid ab$ $A1 \rightarrow a \mid a A1$ $B1 \rightarrow b \mid b B1$	<i>1</i>	<i>The language generated is ambiguous and is the set of all strings over {a,b} with twice as many a's as b's.</i>
<i>B</i>	$E \rightarrow E+E \mid E.E \mid (E) \mid a \mid b \mid \epsilon \mid \phi$	<i>2</i>	<i>The language generated is set of all strings over {a.b} with an unequal number of a's and b's</i>
<i>C</i>	$E \rightarrow E+T \mid T$ $T \rightarrow T * F \mid F$ $F \rightarrow (E) \mid i$	<i>3</i>	<i>The language generated is an unambiguous grammar for arithmetic expressions</i>
<i>D</i>	$S \rightarrow aSbSaS \mid aSaSbS \mid bSaSaS \mid \epsilon$	<i>4</i>	<i>The language generated is ambiguous with three distinct derivations for a</i>
		<i>5</i>	<i>The language generated is inherently ambiguous</i>
		<i>6</i>	<i>The language generated is r.e but not recursive</i>

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
- (ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

- (iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
 (iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$
 Q99.

A	$E \rightarrow E+E E^*E (E) i$	1	The language generated is $\{a^I b^J c^K I \text{ not equal to } J \text{ or } J \text{ not equal to } K\}$
B	$E \rightarrow E+E E.E (E) a b \epsilon \phi$	2	The language generated is ambiguous and is the set of all C expressions over + and *
C	$E \rightarrow E+T T$ $T \rightarrow T * F F$ $F \rightarrow (E) i$	3	The language generated is an unambiguous grammar for arithmetic expressions
D	$S \rightarrow AI BI CI AI CI$ $S \rightarrow AI A AI A CI$ $S \rightarrow B CI AI B CI$ $A \rightarrow aAb ab$ $B \rightarrow aBb ab$ $AI \rightarrow a a AI$ $BI \rightarrow b b BI$ $CI \rightarrow c c CI$	4	The language generated is ambiguous with three distinct derivations for a
		5	The language generated is inherently ambiguous
		6	The language generated is r.e but not recursive

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
 (ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
 (iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
 (iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$
 Q100.

A	$S \rightarrow aSa bSb cSc dSd \epsilon$	1	The language generated is ambiguous and
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			<i>is the set of all strings over {a,b} with twice as many a's as b's.</i>
<i>B</i>	$E \rightarrow E+E E.E (E) a b \varepsilon \phi$	<i>2</i>	<i>The language generated is the set of all palidromes over {a,b,c,d}</i>
<i>C</i>	$E \rightarrow E+T T$ $T \rightarrow T * F F$ $F \rightarrow (E) i$	<i>3</i>	<i>The language generated is an unambiguous grammar for arithmetic expressions</i>
<i>D</i>	$S \rightarrow aSbSaS aSaSbS bSaSaS \varepsilon$	<i>4</i>	<i>The language generated is ambiguous with three distinct derivations for a</i>
		<i>5</i>	<i>The language generated is inherently ambiguous</i>
		<i>6</i>	<i>The language generated is r.e but not recursive</i>

Answer:

(i) A → 1, B → 2, C → 3, D → 4

(ii) A → 2, B → 3, C → 4, D → 5

(iii) A → 3, B → 4, C → 5, D → 6

(iv) A → 2, B → 3, C → 4, D → 1

Q101.

<i>A</i>	$S \rightarrow aSa bSb cSc dSd \varepsilon$	<i>1</i>	<i>The language generated is ambiguous and is the set of all strings over {a,b} with twice as many a's as b's.</i>
<i>B</i>	$\{a^I b^J c^K I = \max(J, K)\}$	<i>2</i>	<i>The language generated is the set of all palidromes over</i>

			$\{a,b,c,d\}$
<i>C</i>	$E \rightarrow E+T T$ $T \rightarrow T*F F$ $F \rightarrow (E) i$	3	The language generated is a csl and not a cfl
<i>D</i>	$S \rightarrow aSbSaS aSaSbS bSaSaS \epsilon$	4	The language generated is ambiguous with three distinct derivations for a
		5	The language generated is inherently ambiguous
		6	The language generated is r.e but not recursive

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
- (ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
- (iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
- (iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q102.

<i>A</i>	$S \rightarrow aSa bSb cSc dSd\epsilon$	1	The language generated is ambiguous and is the set of all strings over $\{a,b\}$ with twice as many a's as b's.
<i>B</i>	$\{a^I b^J c^K I = \min(J,K)\}$	2	The language generated is the set of all palidromes over $\{a,b,c,d\}$
<i>C</i>	$E \rightarrow E+T T$ $T \rightarrow T*F F$ $F \rightarrow (E) i$	3	The language generated is a csl which is not a cfl
<i>D</i>	$S \rightarrow aSbSaS aSaSbS bSaSaS \epsilon$	4	The language generated is ambiguous with three distinct derivations for a

		5	The language generated is inherently ambiguous
		6	The language generated is r.e but not recursive

Answer:

- (i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$
- (ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$
- (iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$
- (iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q103.

A	$S \rightarrow aSa bSb cSc dSd\epsilon$	1	The language generated is ambiguous and is the set of all strings over $\{a,b\}$ with twice as many a's as b's.
B	$\{a^n B^n c^i I \text{ not equal to } n\}$	2	The language generated is the set of all palindromes over $\{a,b,c,d\}$
C	$E \rightarrow E+T T$ $T \rightarrow T*F F$ $F \rightarrow (E) i$	3	The language generated is a csl which is not a cfl
D	$S \rightarrow aSbSaS aSaSbS bSaSaS \epsilon$	4	The language generated is ambiguous with three distinct derivations for a
		5	The language generated is inherently ambiguous
		6	The language generated is r.e but not recursive

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q104.

A	$S \rightarrow aSa bSb cSc dSd\epsilon$	1	The language generated is ambiguous and is the set of all strings over $\{a,b\}$ with twice as many a's as b's.
B	$\{a^m B^n c^l n \text{ lies between } m \text{ and } 2l\}$	2	The language generated is the set of all palindromes over $\{a,b,c,d\}$
C	$E \rightarrow E+T T$ $T \rightarrow T*F F$ $F \rightarrow (E) I$	3	The language generated is a csl which is not a cfl
D	$S \rightarrow aSbSaS aSaSbS bSaSaS \epsilon$	4	The language generated is ambiguous with three distinct derivations for a
		5	The language generated is inherently ambiguous
		6	The language generated is r.e but not recursive

Answer:

(i) $A \rightarrow 1, B \rightarrow 2, C \rightarrow 3, D \rightarrow 4$

(ii) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 5$

(iii) $A \rightarrow 3, B \rightarrow 4, C \rightarrow 5, D \rightarrow 6$

(iv) $A \rightarrow 2, B \rightarrow 3, C \rightarrow 4, D \rightarrow 1$

Q105.

A	$S \rightarrow aSa bSb cSc dSd\epsilon$	1	The language generated is ambiguous and
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			<i>is the set of all strings over {a,b} with twice as many a's as b's.</i>
<i>B</i>	$\{a^n B^n c^I I \text{ not equal to } n\}$	<i>2</i>	<i>The language generated is the set of all palidromes over {a,b,c,d}</i>
<i>C</i>	$\{a^I b^J c^K K=I+J\}$	<i>3</i>	<i>The language generated is a csl which is not a cfl</i>
<i>D</i>	$S \rightarrow aSbSaS aSaSbS bSaSaS \epsilon$	<i>4</i>	<i>The language generated is a dcfl which is not regular</i>
		<i>5</i>	<i>The language generated is inherently ambigugous</i>
		<i>6</i>	<i>The language generated is r.e but not recursive</i>

Answer:

(i) A → 1, B → 2, C → 3, D → 4

(ii) A → 2, B → 3, C → 4, D → 5

(iii) A → 3, B → 4, C → 5, D → 6

(iv) A → 2, B → 3, C → 4, D → 1

Q106.

<i>A</i>	$S \rightarrow aSa bSb cSc dSd \epsilon$	<i>1</i>	<i>The language generated is ambiguous and is the set of all strings over {a,b} with twice as many a's as b's.</i>
<i>B</i>	$\{a^n B^n c^I I \text{ not equal to } n\}$	<i>2</i>	<i>The language generated is the set of all palidromes over {a,b,c,d}</i>
<i>C</i>	$\{a^I b^J c^K K < I, K < J\}$	<i>3</i>	<i>The language generated is a</i>

			<i>csl which is not a cfl</i>
<i>D</i>	$S \rightarrow aSbSaS aSaSbS bSaSaS \epsilon$	<i>4</i>	<i>The language generated is a cfl which is not a dcfl</i>
		<i>5</i>	<i>The language generated is inherently ambiguous</i>
		<i>6</i>	<i>The language generated is r.e but not recursive</i>

Answer:

- (i) A → 1, B → 2, C → 3, D → 4*
- (ii) A → 2, B → 3, C → 4, D → 5*
- (iii) A → 3, B → 4, C → 5, D → 6*
- (iv) A → 2, B → 3, C → 4, D → 1*

Q106.

<i>A</i>	$\{a^i b^j c^j d^{2i} e^{3i}\}$	<i>1</i>	<i>The language generated is ambiguous and is the set of all strings over {a,b} with twice as many a's as b's.</i>
<i>B</i>	$\{a^n b^n c^i i \text{ not equal to } n\}$	<i>2</i>	<i>The language is a cfl and if we take the first half of the strings we get a language which is not a cfl</i>
<i>C</i>	$E \rightarrow E+T T$ $T \rightarrow T * F F$ $F \rightarrow (E) i$	<i>3</i>	<i>The language generated is a csl which is not a cfl</i>
<i>D</i>	$S \rightarrow aSbSaS aSaSbS bSaSaS \epsilon$	<i>4</i>	<i>The language generated is ambiguous with three distinct derivations for a</i>
		<i>5</i>	<i>The language</i>

			<i>generated is inherently ambiguous</i>
		6	<i>The language generated is r.e but not recursive</i>

Answer:

- (i) A → 1, B → 2, C → 3, D → 4*
- (ii) A → 2, B → 3, C → 4, D → 5*
- (iii) A → 3, B → 4, C → 5, D → 6*
- (iv) A → 2, B → 3, C → 4, D → 1*

NOTE:-The answer for all the above questions is choice (IV)

