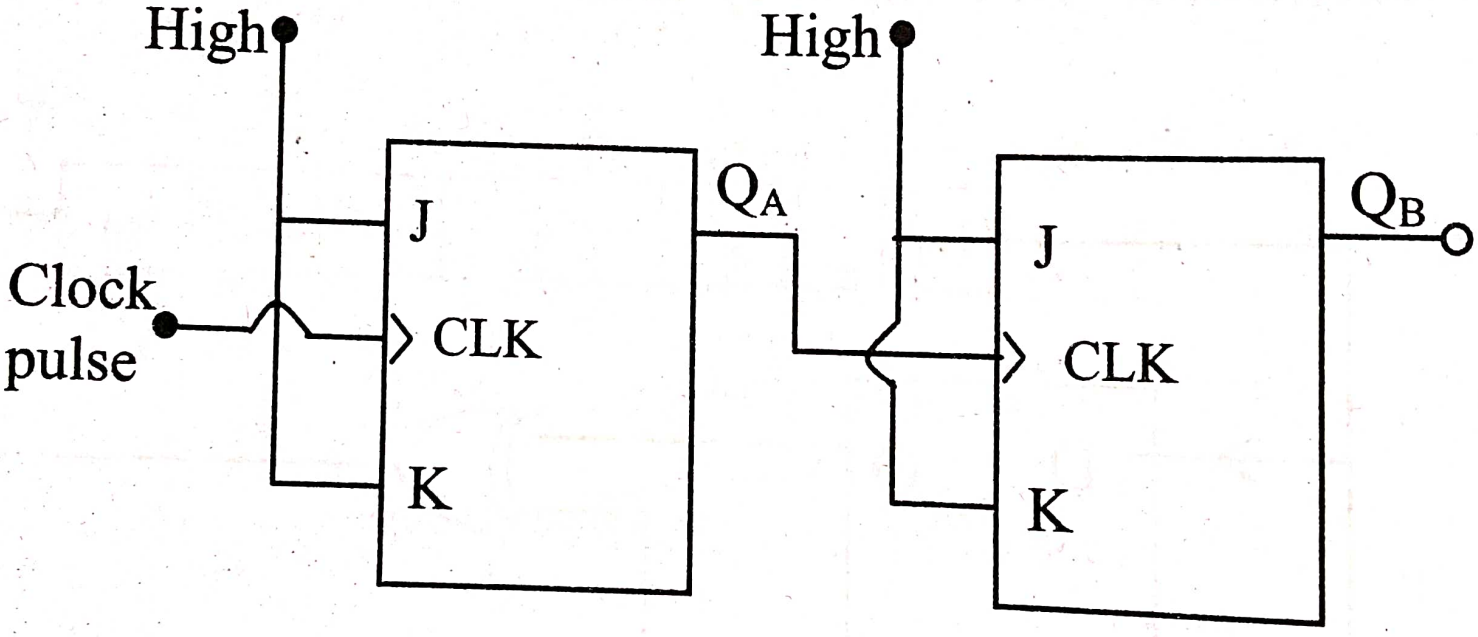
13. The circuit shown below illustrates a typical application of the J-K flip-flops. What does this represent?



(a) A shift register

(b) A data storage device

(c) A frequency divider circuit

(d) A decoder circuit

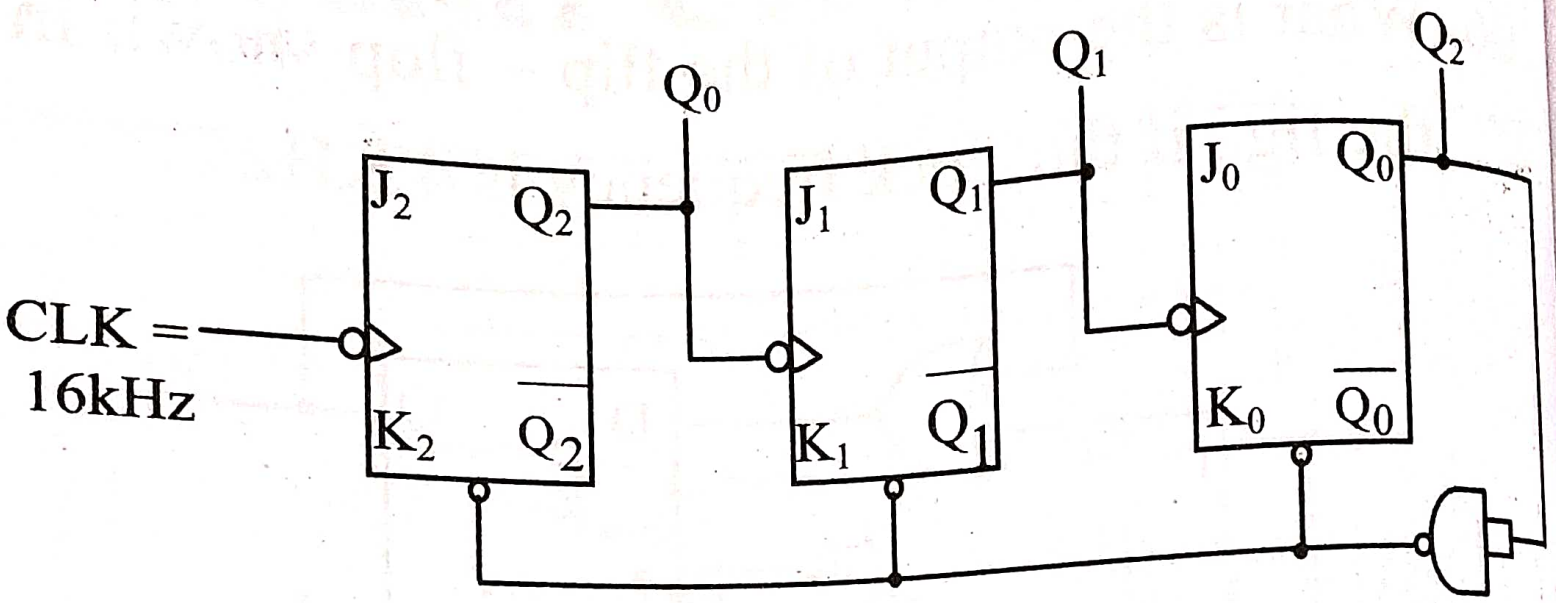
(c) 13⇒

CLK	Q_A	Q_B
0	0	0
1	1	1
2	0	1
3	1	0
4	0	0

It is a MOD-4 counter.

Also called frequency divider circuit.

14. What is the output signal frequency of the following counter if the clock signal frequency is 16 KHz? All 'J' and 'K' inputs are connected to1.



(a) 4 KHz

(b) 8 KHz

(c) 10 KHz

(d) 16 KHz

(a) 19→

Clk	Q_2	Q_1	Q_0
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	0	0	0

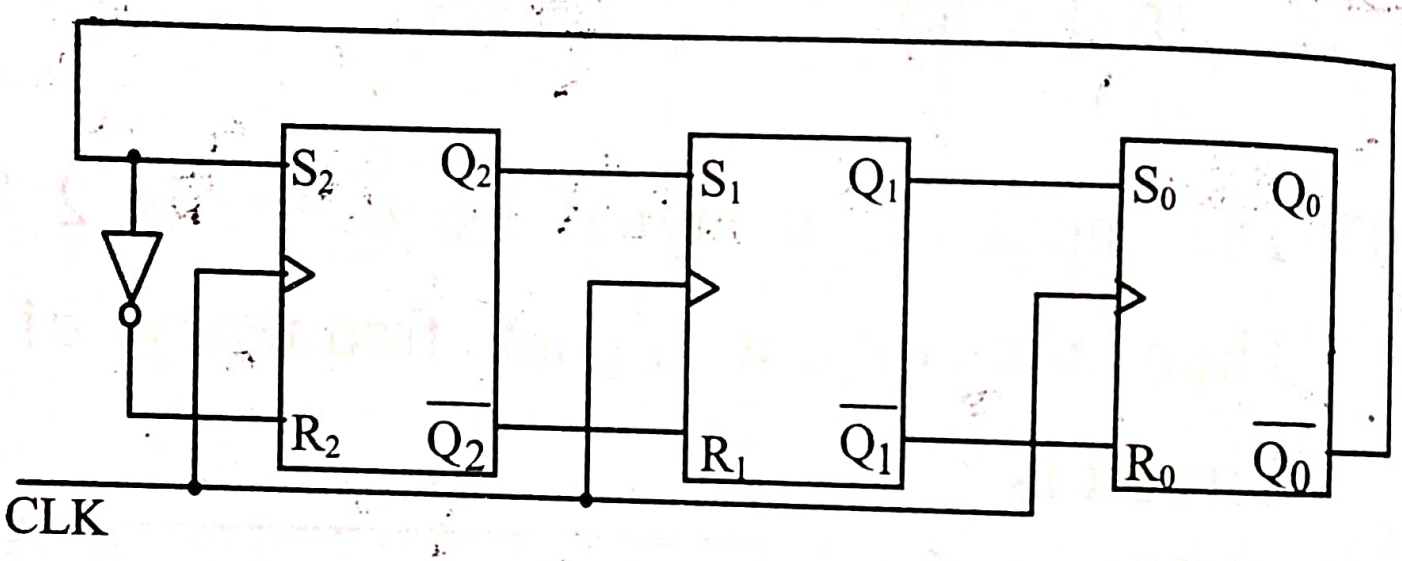
4 State

$$f_{out} = \frac{f_{in}}{\text{MOD-No.}}$$

$$= \frac{16K}{4}$$

(a) $= 4\,KH_2$

15. How many different output states the following circuit is having?



(a) 3

(b) 4

(c) 5

(d) 6

(d) LS⇒

				Q_0	Q_0	Q_2	Q_2	Q_1	Q_1
CLK	Q_2	Q_1	Q_0	S_2	R_2	S_1	R_1	S_0	R_0
0	0	0	0	1	0	0	1	0	1
1	1	0	0	1	0	1	0	0	1
2	1	1	0	1	0	1	0	1	0
3	1	1	1	0	1	1	0	1	0
4	0	1	1	0	1	0	1	1	0
5	0	0	1	0	1	0	1	0	1
6	0	0	0						

(d) 6 State

16. The number of unused states in a 4-bit Johnson counter is

(a) 2 (b) 4

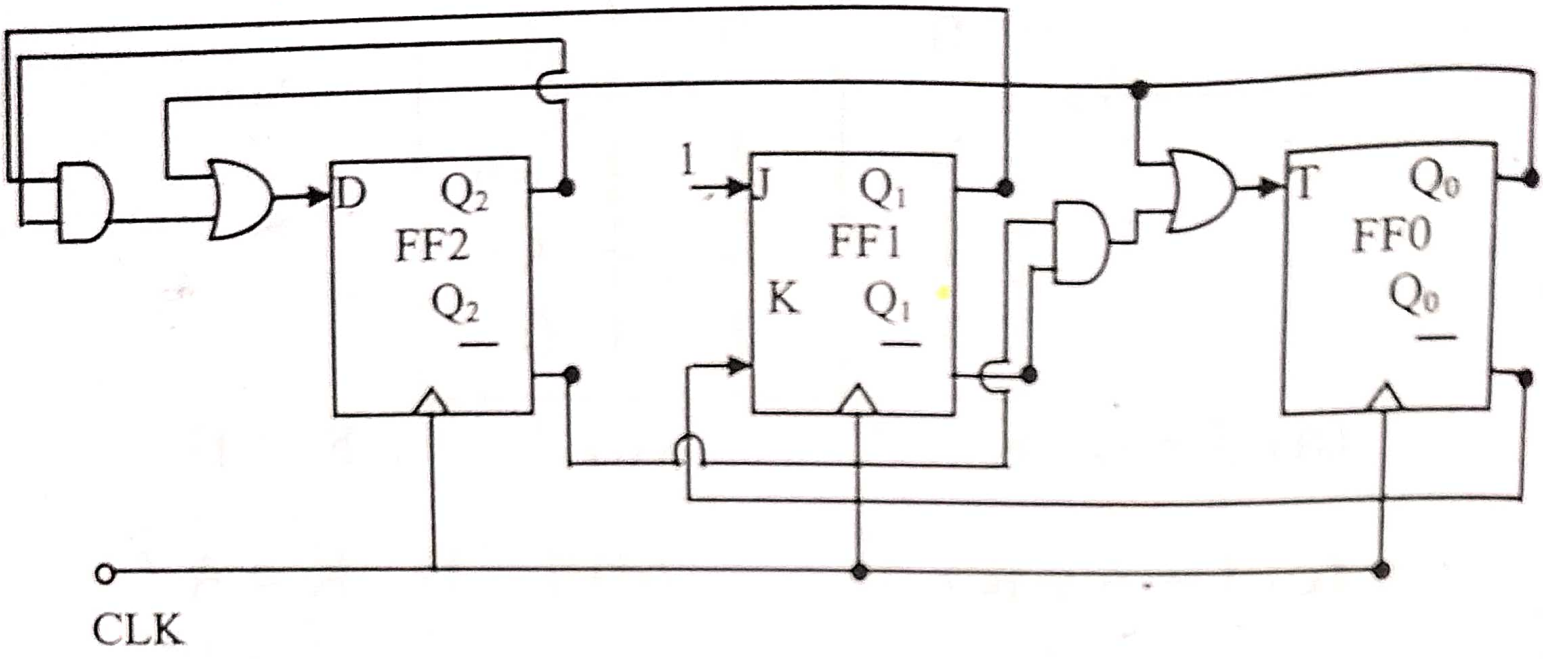
(c) 8 (d) 12

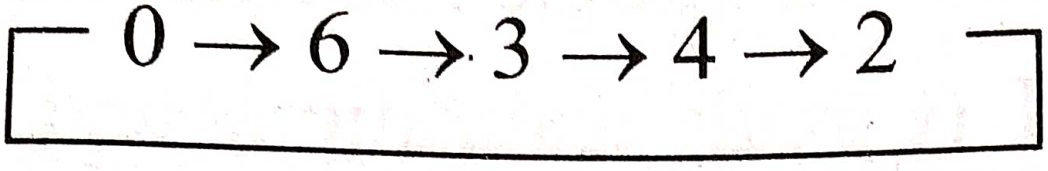
(C) 46=> 4-bit Johnson counter = Total state − No. of used state

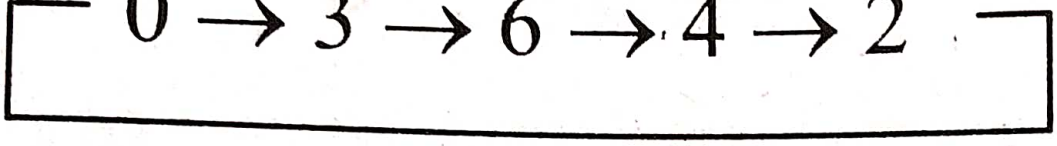
$= 2^4 - 2 \times 4$

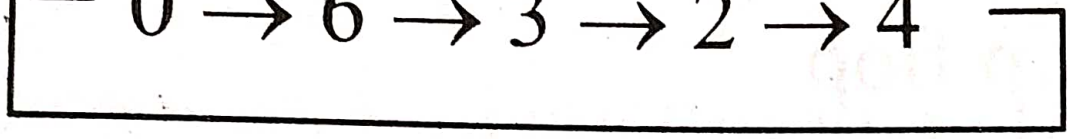
(C) $= \boxed{8}$

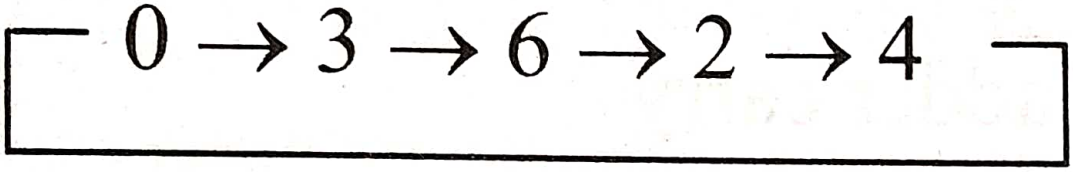
17. The switching sequence is



(a) 

(b) 

(c) 

(d) 

(b) 17→

Q_2	Q_1	Q_0	D	J	K	T
0	0	0	0	1	1	1
0	1	1	1	1	0	1
1	1	0	1	1	1	0
1	0	0	0	1	1	0
0	1	0	0	1	1	0

(b) → 0 → 3 → 6 → 7 → 2

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18. How many flip–flops are required to construct Mod–31 counter?

(a) 4

(b) 3

(c) 2

(d) 5

Q18 =

$n = 31$

$31 \leq 2^n \Rightarrow 31 \leq 2^5$ (5 → n)

(d) $n = 5$

19. In which of the following counters lock out problem ***not*** present ?

(a) Mod – 3

(b) Mod – 7

(c) Mod – 1

(d) Mod – 16

(d) 19-1 not present -

(a) 3 $\longrightarrow$ 2^n (✗)

(b) 7 $\longrightarrow$ 2^n (✗)

(c) 1 $\longrightarrow$ 2^n

(d) 16 $\longrightarrow$ 2^4 (✓)

20. Match List–I (Digital Circuits) with List–II (Circuit type) and select the ***correct*** answer using the codes given below

List – I	List – II
P) ROM	1) Sequential Circuit
Q) Serial adder	2) Combinational
R) Code Converter	3) Neither Combinational nor sequential
S) Sequence detector	

Codes:

	P	Q	R	S
(a)	2	1	2	2
(b)	2	1	2	3
(c)	2	1	2	1
(d)	1	1	2	2

(C) 20?

List - I	List - II
P) ROM	1) Sequential
Q) Serial Adder	2) Combinational
R) Code converter	3) Not both
S) Sequence decter	

(C)

P → 2
Q → 1
R → 2
S → 1

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21. Match List – I with List – II and select the correct answer by using the code given below the lists :

List – I	List – II
P) Multiplexer	1) Sequential Memory
Q) De - Multiplexer	2) Converts decimal number to binary
R) Shift - register	3) Data selector
S) Encoder	4) Routes out many data output with signal input

	P	Q	R	S
(a)	3	4	1	2
(b)	3	4	2	1
(c)	4	3	1	2
(d)	1	2	3	4

(21) 21 → (9)

P → 3

Q → 9

R → 1

S → 2

22. Which one of the following Shift register operation can be used as digital delay line ?

(a) Parallel input – Serial output

(b) Serial input – Parallel output

(c) Parallel input – Parallel output

(d) Serial input – Serial output

(d) 22⇒ Used as digital delay line —

(d) Serial i/p — Serial o/p

23. A 3 bit modulo-8 ripple counter uses JK flip-flops. If the propagation delay of each FF is 40 ns, the maximum clock frequency that can be used is equal to:

(a) 20 MHz
(b) 10 MHz
(c) 8.33 MHz
(d) 4 MHz

Q 23 → Propagation delay (T_d) = 40 ns

$n = 3$

$$f = \frac{1}{T_d \times n} = \frac{1}{40 \times 10^{-9} \times 3}$$

$$f = 8.33 \text{ MHz}$$

24. Determine the characteristic equation of XY flip flop, whose truth table is as shown below.

X	Y	Q_{n+1}
0	0	1
0	1	Q_n
1	0	$\overline{Q}_n$
1	1	0

(a) $Q_{n+1} = \overline{Y}\,\overline{Q}_n + \overline{X}Q_n$

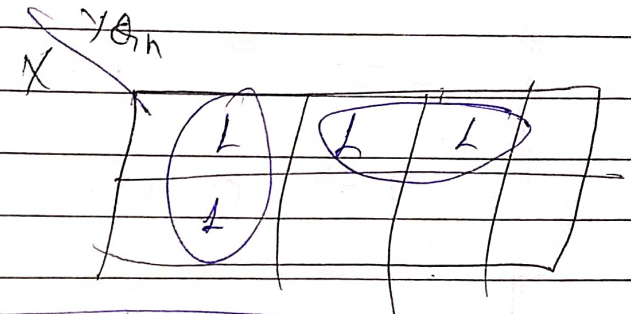
(b) $Q_{n+1} = YQ_n + XQ_n$

(c) $Q_{n+1} = Y \oplus Q_n$

(d) $Q_{n+1} = Y \odot Q_n$

(a) 2 मार्क

X	Y	Q_n	Q_{n+1}
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	0



(a) $Q_{n+1} = \bar{Y}\,\bar{Q}_n + \bar{X}\,Q_n$

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25. The number of states in a 5 bit Ring, 5 bit Johnson counter and the number of unused states in a 5 bit Ring, Johnson counter

(a) 10, 5, 27, 22

(b) 5, 10, 27, 22

(c) 10, 5, 22, 27

(d) 5, 10, 22, 27

(b) Q5 →

No. of States.

5 bit ring counter = 5

5 bit Johnson counter = 10

No. of unused state

5 bit ring counter = $2^5 - 2 = 27$

5 bit Johnson counter = $2^5 - 10 = 22$

(b) 5, 10, 22, 22

26. Match List-I (circuit) with List-II (application) and select the correct answer using the Code given below lists :

List-I	List-II
1) Division	P. Ripple up counter
2) Multiplication	Q. Shift Left Register
3) Transient states	R. Shift Right Register

	P	Q	R
(a)	2	3	1
(b)	3	1	2
(c)	2	1	3
(d)	3	2	1

(d) 26→

(d)

P → 3

Q → 2

R → 1

27. Match List – I (Logic function circuit) with List – II (Circuit realization) and select the correct answer using code given below list.

List – I

(A) D-flip flop

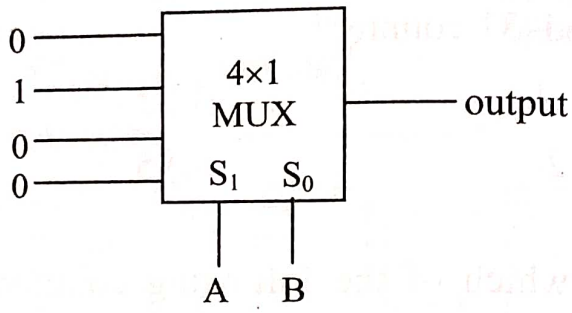
(B) T-flip flop

(C) half subtractor borrow

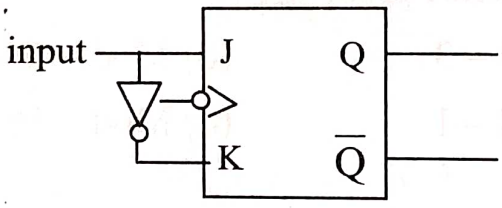
(D) half adder carry

List – II

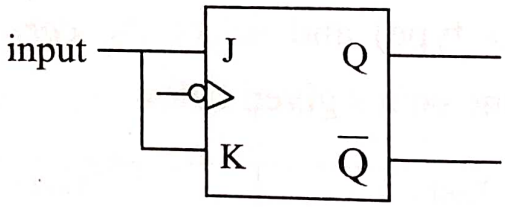
1.



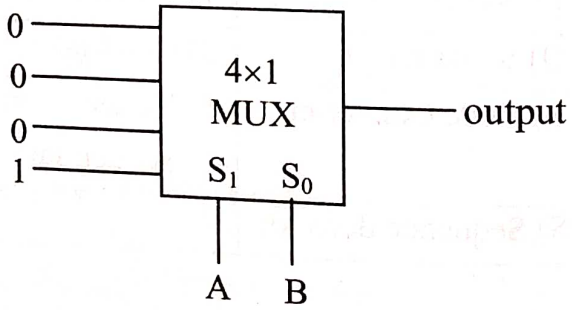
2.



3.



4.



Codes:

	A	B	C	D
(a)	2	3	1	4
(b)	2	3	4	1
(c)	3	2	4	1
(d)	3	2	1	4

(a) 27.

1 → $0 \cdot \bar{A}\bar{B} + 1 \cdot \bar{A}B + 0 \cdot A\bar{B} + 0 \cdot AB = \bar{A}B$

2 → (1) - FF

3 → T - FF

4 → $0 + 0 + 0 + 1 \cdot AB = AB$

(a)

D →	4
A →	2
B →	3
C →	1

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