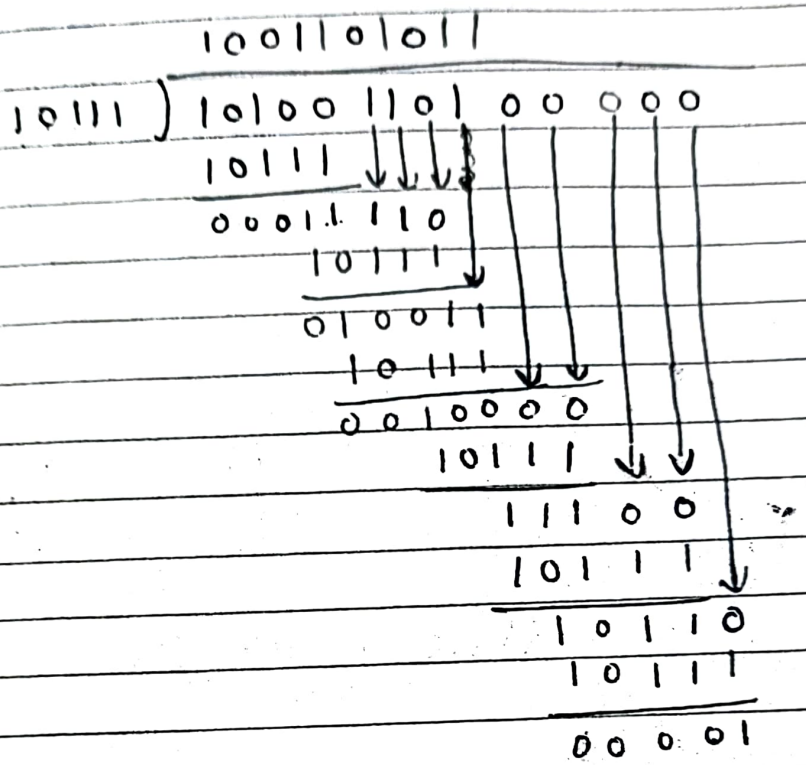
Ans 1 (a) Dataword - 10100110

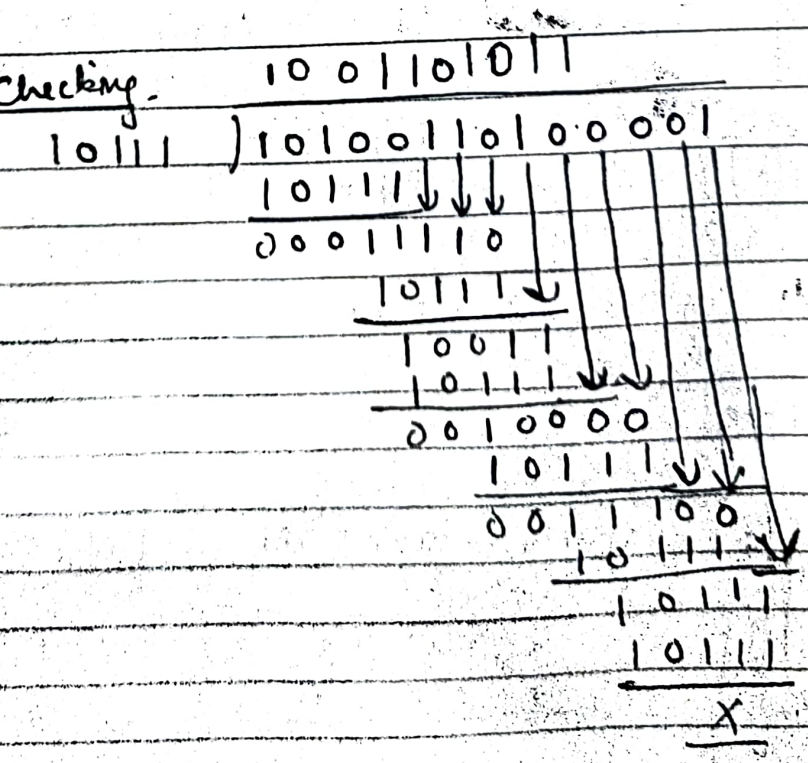
Divisor - 10111

Augmented Word - 10100110 0000

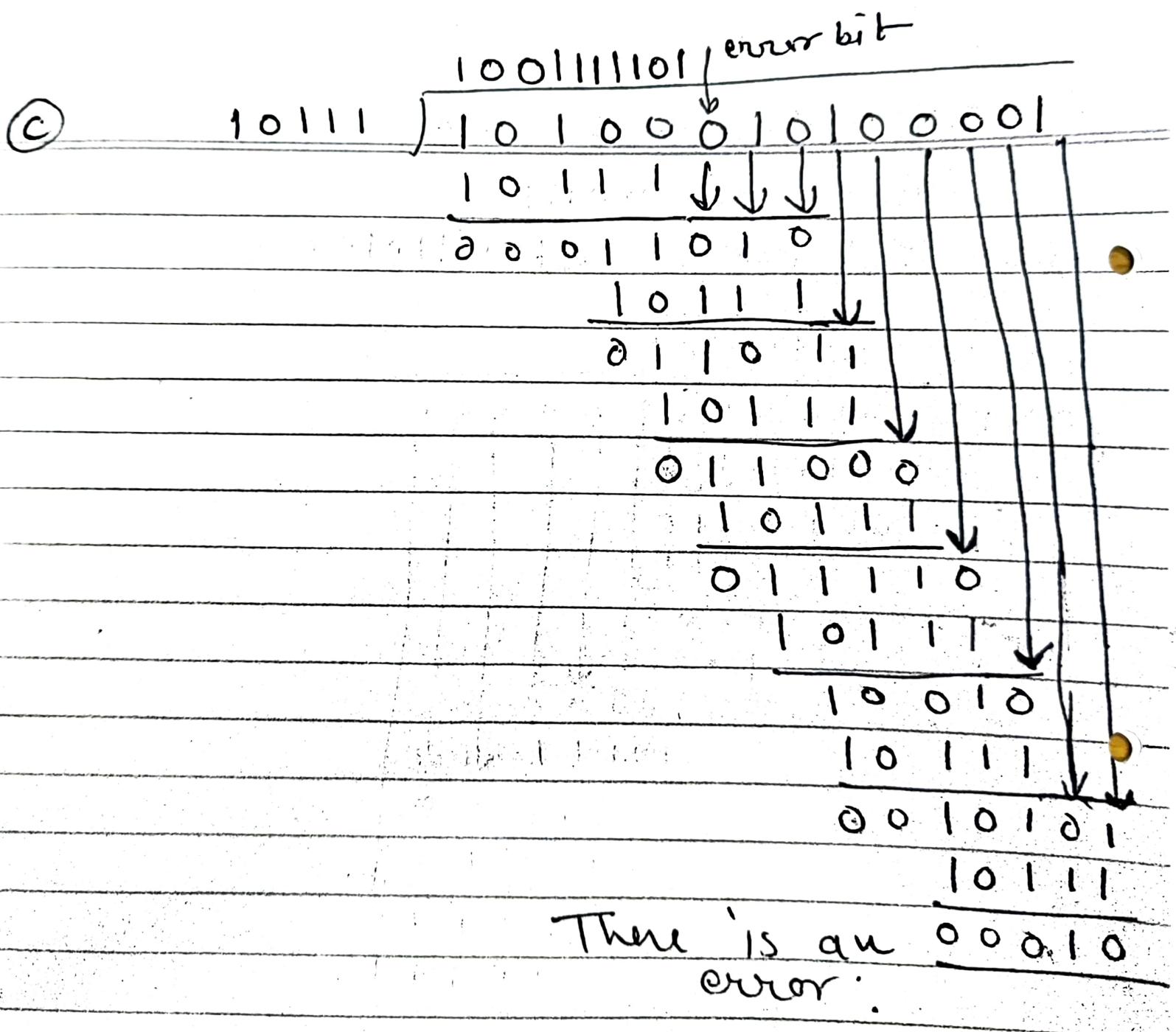


Generated code Word - 10100110 10000 1

(b) No error Checking.



No error found



There is an error.

Ans 2 @ Data Word – $x^8+x^7+x^5+x+1$

Divisor – x^3+x+1

Augmented D.W → $x^{11}+x^{10}+x^8+x^4+x^3$.

$$
\begin{array}{r|l}
x^3+x+1 & x^8+x^7+x^6+x^5+x^2+x \\
\hline
x^{11}+x^{10}+x^8+x^4+x^3 & \\
x^{11}+x^9+x^8 & \\
\hline
x^{10}+x^9+x^4+x^3 & \\
x^{10}+x^8+x^7 & \\
\hline
x^9+x^8+x^7+x^4+x^3 & \\
x^9+x^7+x^6 & \\
\hline
x^8+x^6+x^4+x^3 & \\
x^8+x^6+x^5 & \\
\hline
x^5+x^4+x^3 & \\
x^5+x^3+x^2 & \\
\hline
x^4+x^2+x & \\
x^4+x^2+x & \\
\hline
0 &
\end{array}
$$

Code Word → $x^{11}+x^{10}+x^8+x^4+x^3+x$

(b)

$$
\begin{array}{r|l}
x^3+x+1 & x^8+x^7+x^5+x^4+x^3+x \\
\hline
x^{11}+x^{10}+x^9+x^8+x^4+x^3+x & \\
x^{11}+x^9+x^8 & \\
\hline
x^{10}+x^4+x^3+x & \\
x^{10}+x^8+x^7 & \\
\hline
x^8+x^7+x^4+x^3+x & \\
x^8+x^6+x^5 & \\
\hline
x^7+x^6+x^5+x^4+x^3+x & \\
x^7+x^5+x^4 & \\
\hline
x^6+x^3+x & \\
x^6+x^4+x^3 & \\
\hline
x^4+x & \\
x^4+x^2+x & \\
\hline
x^2 &
\end{array}
$$

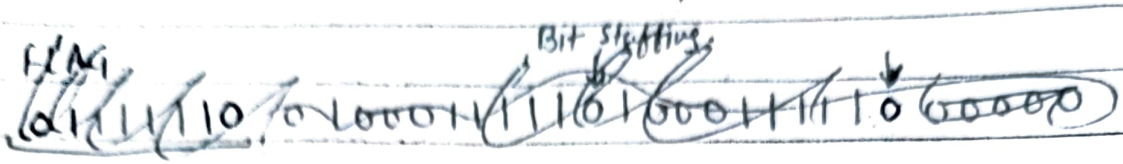
errored Data

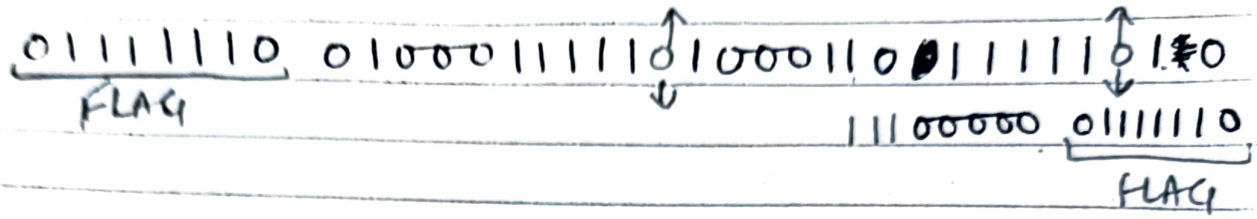
Remainder (error)

Ans 3 A → 01000111 FLAG → 01111110

B → 11100011 ESC → 11100000

Show → A B FLAG ESC with Bit stuffing.

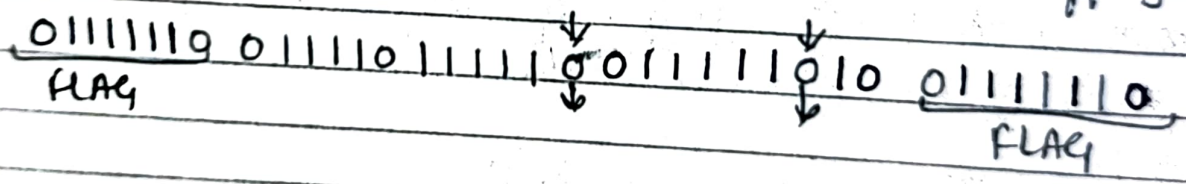




Ans 4 Bit string →

01111011111011111110 ⇒

What will be transmitted signal after Bit stuffing.



Ans 5 Channel Data Rate - 4 Kbps.

t_{ps} - 20 ms

Frame Range for stop & wait for atleast 50% efficiency.

$$U = \frac{T_{frame}}{T_{frame} + 2T_{ps}} = \frac{L/R}{L/R + 2T_{ps}}$$

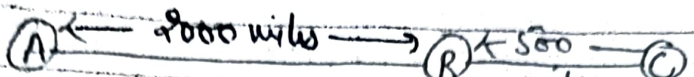
Where L - Frame length R - Channel capacity (4 Kbps)

$$0.5 = \frac{L/4}{L/4 + 2 \times 20}$$

$$0.5 = \frac{L}{L+160}$$

$$L = 0.5 \times 160 / 0.5 \Rightarrow 160 \text{ bits}$$

Ans 6



Sliding window W=3 — Stop & Wait

From A to B →

Propagation $T_1 = T_{frame} + 2T_{ps}$

$$T_1 = \frac{1000}{100 \text{ Kbps}} + 2 \times 20 \text{ ms} = 10 \text{ ms} + 40 \text{ ms}$$

$$T_1 = 50 \text{ ms}.$$

In every 50 ms, 3- frames of 1000 bit each tx from A to B.

From B to C → Buffer of node B will flooded because of the previous link.

$$T_2 = T_{frame2} + 2T_{ps2}$$

$$= L/R_2 + 2 \times 5 \text{ ms}.$$

$$T_2 = \frac{1000}{R_2} + 10 \text{ ms}$$

In T_2 time 1 frame send from B to C. To send 3- frame we require - $3T_2$ time.

$3T_2 = 50$ ms (Not flooding B)

$$50 = 3\left(\frac{1000}{R_2} + 10\right)$$

$$\left(\frac{50}{3} - 10\right) = \frac{1000}{R_2} \Rightarrow \frac{20}{3} = \frac{1000}{R_2}$$

$$R_2 = \frac{1000 \times 3}{2d}$$

$$\Rightarrow 50 \times 3 = 150 \text{ Kbps.}$$