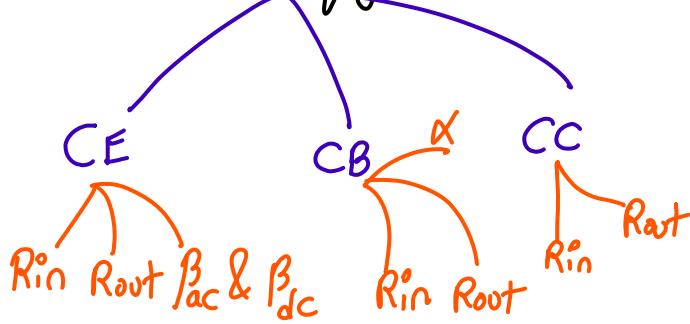
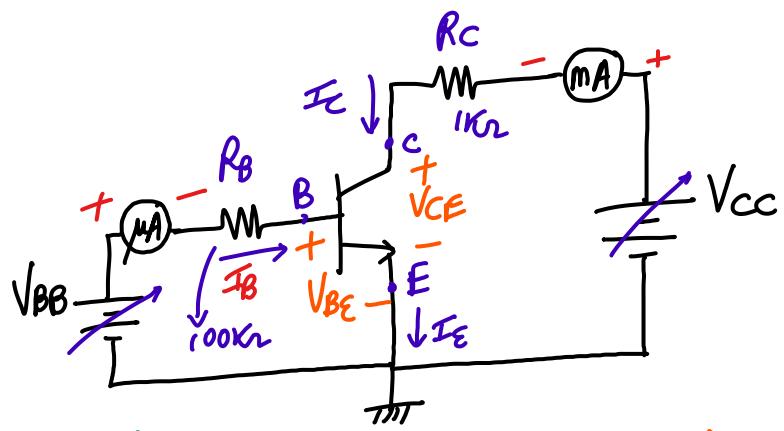
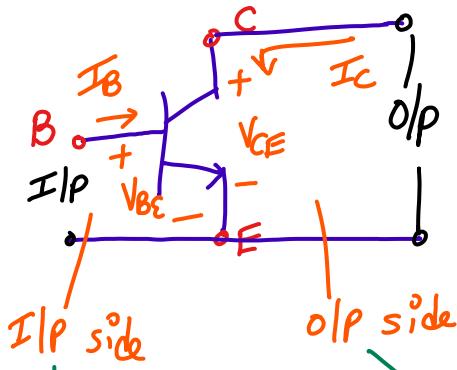


* BJT configurations:



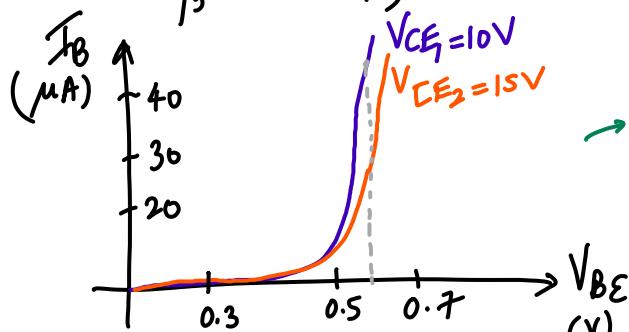
1) CE configuration: (NPN BJT)



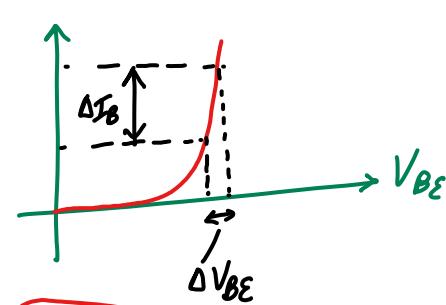
I_B characteristics:
 I_B vs V_{BE} | V_{CE} constant

O/p characteristics:
 I_C vs V_{CE} | I_B constant

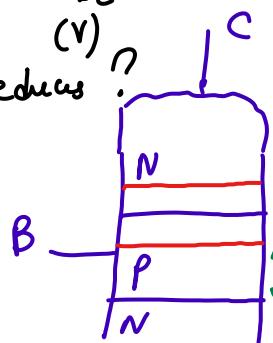
$$I_B = \frac{I_S}{\beta} \exp\left(\frac{V_{BE}}{V_T}\right)$$



I_B characteristics



Why as V_{CE} increases $\rightarrow I_B$ reduces?



$$R_{in} = \frac{\Delta V_{BE}}{\Delta I_B} \quad | \quad V_{CE} = \text{constant}$$

I/p resistance of BJT in CE mode

$$V_{BC} = V_{BE} - V_{CE}$$

-0.3V
0.7V
1V
2V
-1.3V

As $V_{CE} \uparrow \rightarrow V_{BC} \uparrow \rightarrow$ BC $\downarrow \rightarrow$ more R_B

\downarrow
Early effect

$I_B \downarrow \text{seq} \leftarrow$ less recombination in Base

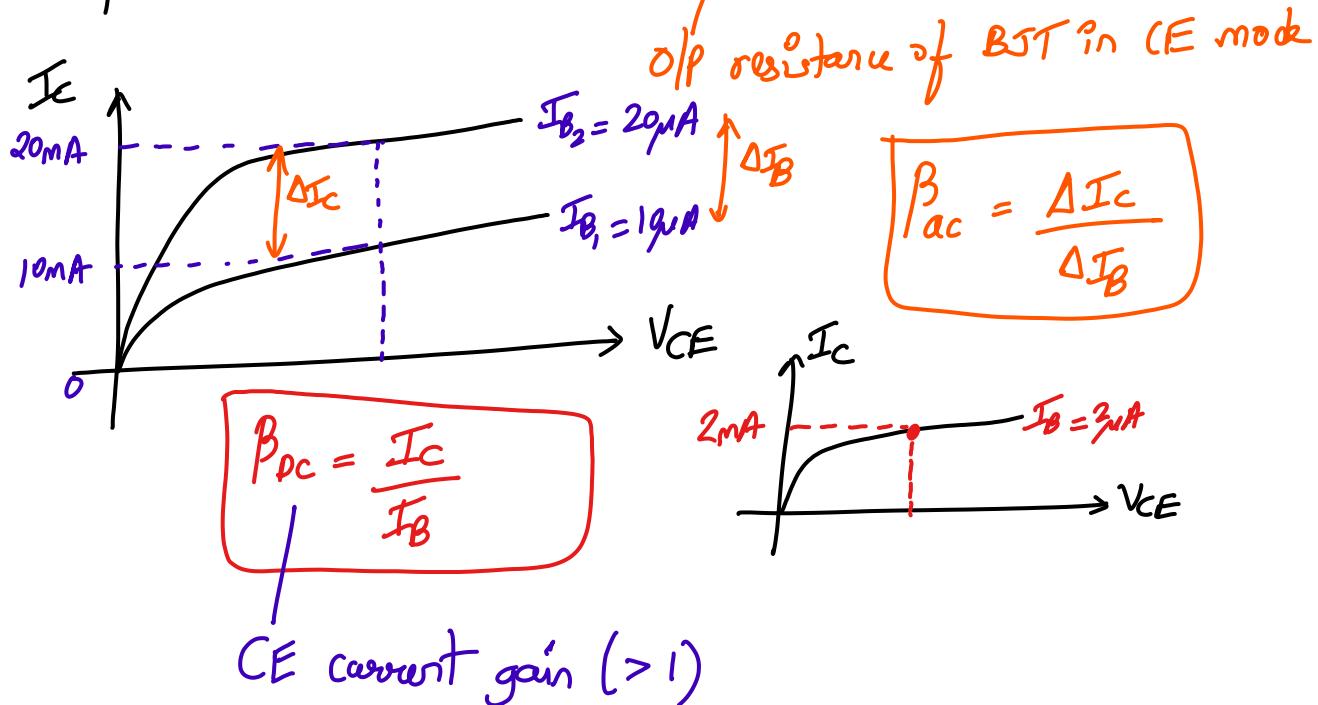
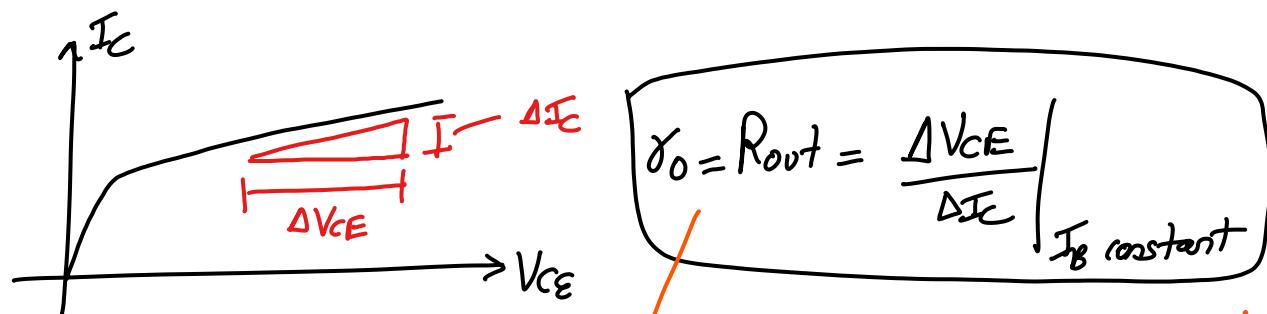
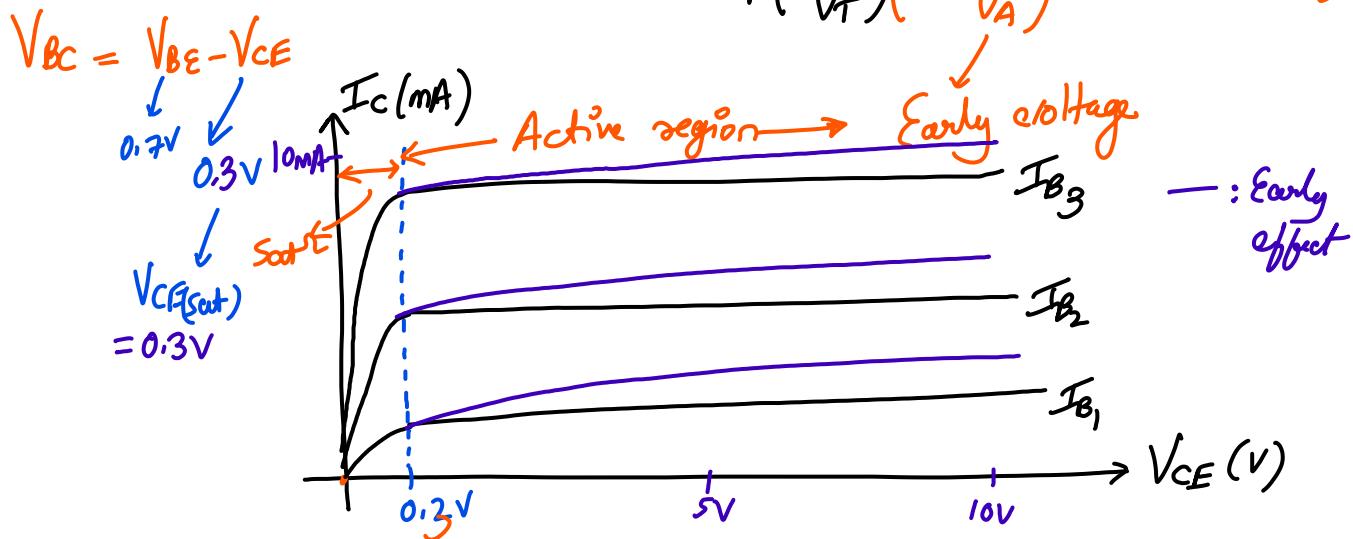
O/P characteristics:-

I_C Vs V_{CE} / I_B constant

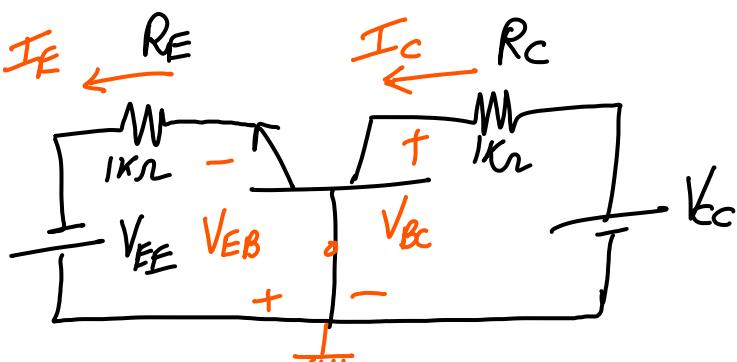
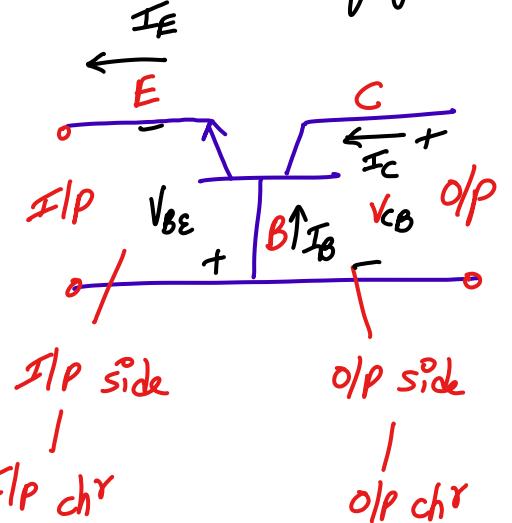
$$I_C = I_S \exp\left(\frac{V_{BE}}{V_T}\right) \rightarrow I_C = f^{\gamma}(V_{BE})$$

↳ independent of V_{CE}

$$I_C = I_S \exp\left(\frac{V_{BE}}{V_T}\right) \left(1 + \frac{V_{CE}}{V_A}\right) \rightarrow I_C = f^{\gamma}(V_{BE}, V_{CE})$$



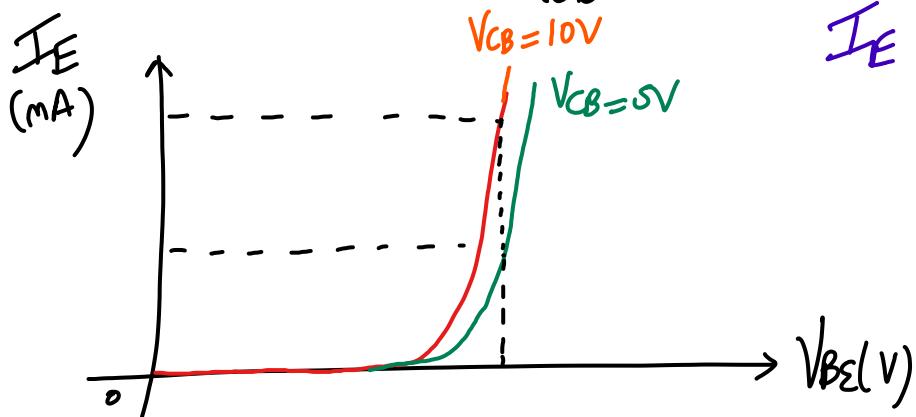
2) Common Base configuration:-



I_E vs V_{BE} / V_{CB} constant

I_P characteristics

I_E vs V_{BE}) V_{CB} constant



$$I_E = \frac{I_S}{\kappa} \exp\left(\frac{V_{BE}}{V_T}\right)$$

- For a given value of V_{BE} \rightarrow why I_E increases with increase in V_{CB}

Ans: Due to Early effect

$$I_E = I_C + I_B$$

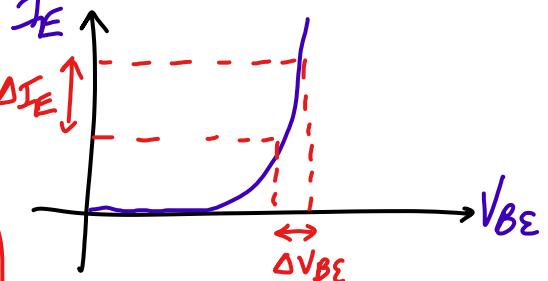
\uparrow mA \downarrow μA

\Rightarrow ① I_B increases

\Rightarrow ② I_C increases

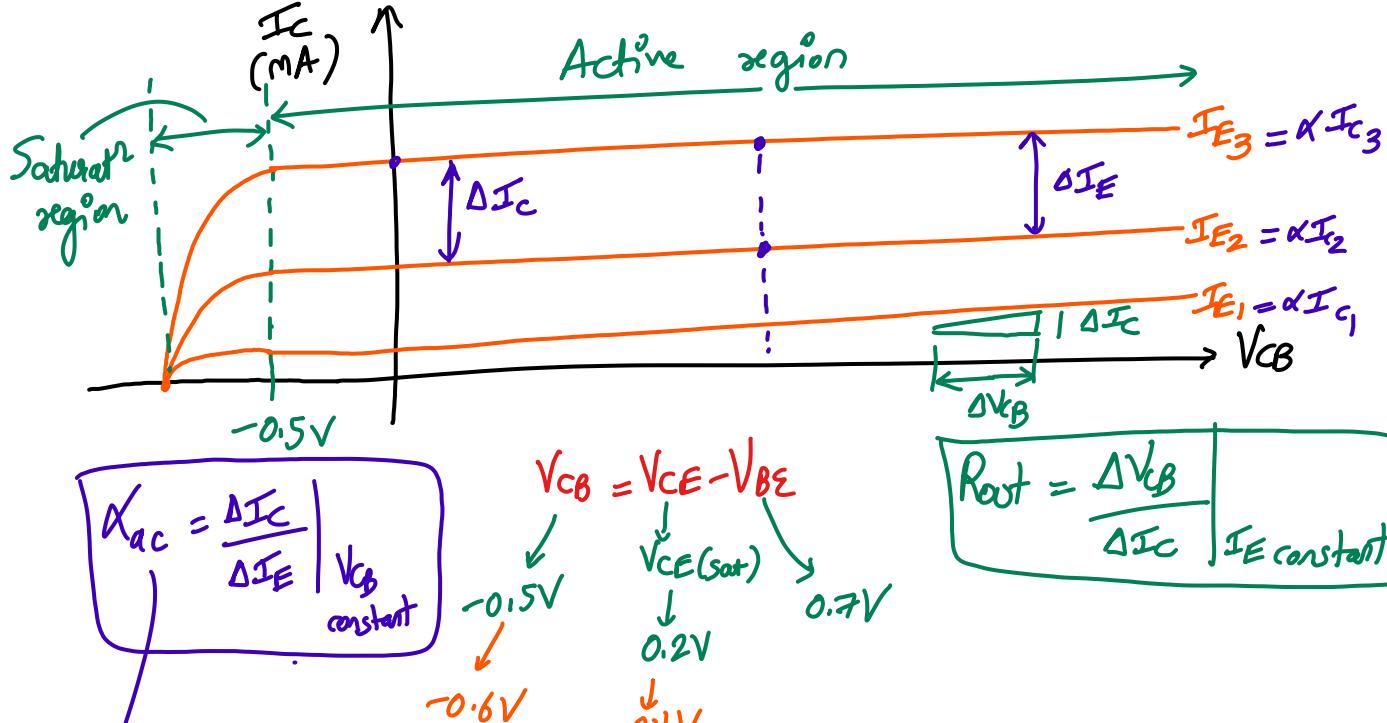
$I_E \uparrow$ seq

$R_{in}^o = \frac{\Delta V_{BE}}{\Delta I_E}$ | V_{CB} constant

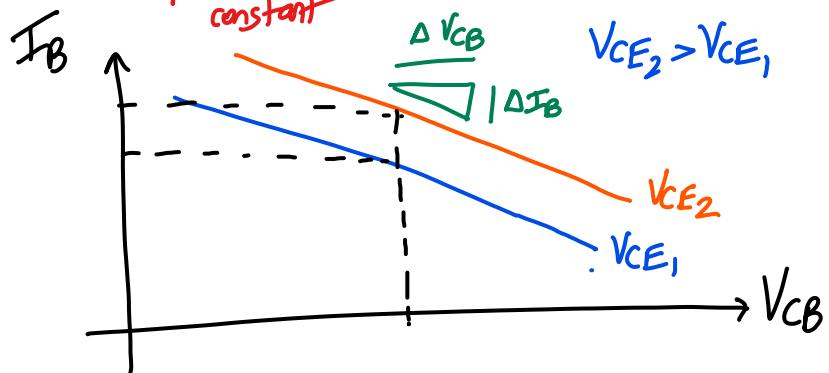
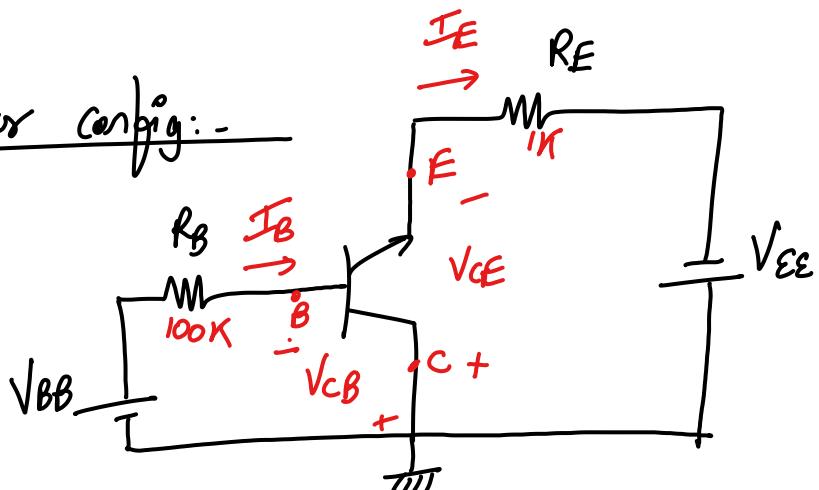


I_P resistance of BJT in CB mode

O/P characteristics (CB): I_C Vs V_{CB}



3) Common collector config:-



$$R_{in} = \frac{\Delta V_{CB}}{\Delta I_B} \quad | \quad V_{CE}$$

high value

As $V_{CB} \uparrow \rightarrow C.B J^n \rightarrow \text{more } R.B \rightarrow \text{effective Base width } (W_B) \text{ reduces}$

$$V_{CB} = V_{CE} - V_{BE}$$

V_{CE}

V_{BE}

$0.7V$

$-0.4V$

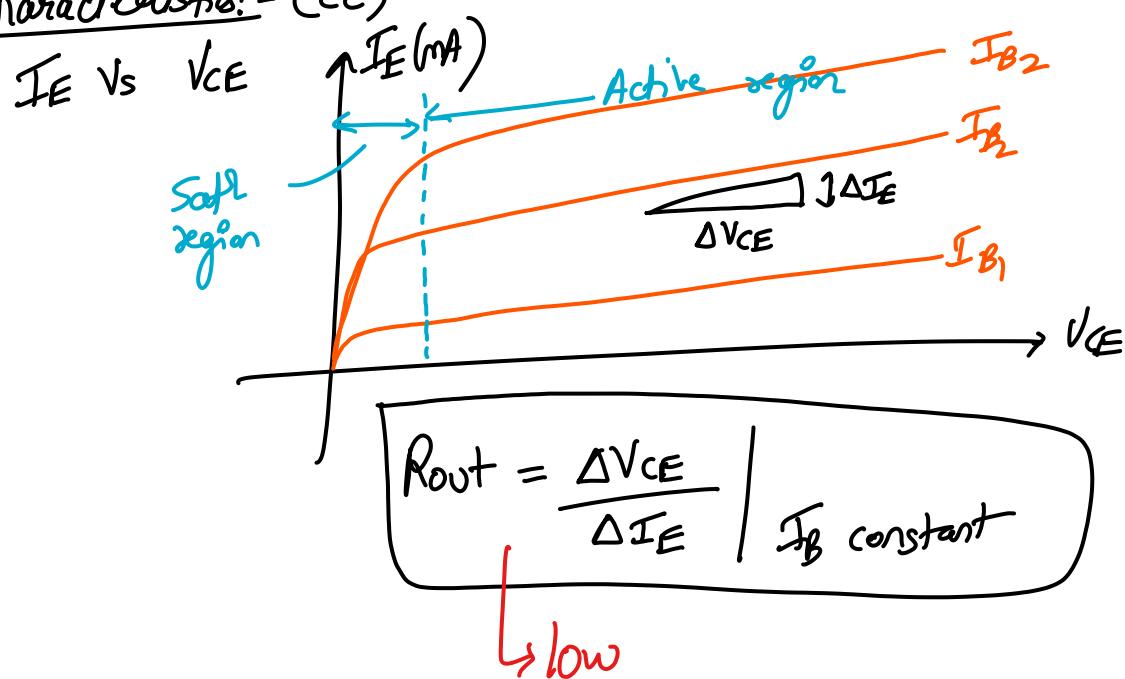
$0.3V$

$-0.3V$

$0.4V$

$I_B \downarrow \text{reses} \quad \leftarrow \text{less recombination in Base}$

O/P characteristic:- (CC)



67, 44, 1, 61, 88, 101,
41, 24, 25, 11, 9,
78, 97, 85, 69, 58, 70, 6, 50, 64

Attendance (AEC lec 4 @ 26/7/23)

