CNF

Question -1) Remove unit productions from the Cfg below

    a) W' -> W
        W -> TWY | t | TW | WY
        T -> tTW | t | tW
        Y ->WyW|T|yy

    b) S' -> S
        S -> RSR | rT | RS | SR | r
        R -> T | S
        T -> t

    c) S -> A | B
        A -> aAs | a | bb | AS
        B -> A | aa | SbS
        C -> c

Question -2) Eliminate null productions from the Cfg below

    a) W' -> W
        W -> TWY | t | TW | WY
        T -> tTW | t | ε
        Y ->WyW|T|yy

    b) S -> A | B
        A -> aAs | a | bb | ε
        B -> A | aa | SBS | ε
        C -> c

    c) S' -> S
        S -> RSR | rT | RS | SR | ε
        R -> T
        T -> t

Question -3)Eliminate useless variables from the Cfg below

    a) S -> aAa | bBb| aa
        A -> a
        B -> b
        C -> a | b | ab

    b) W' -> a
        W -> TW | t | TW
        T -> tTW | t | ε
        Y -> c

c) S -> A | B
   E -> A | B
   A -> aAs | a | bb | ε
   B -> A | aa | SBS | ε
   C -> ε
   D -> a | b

Question -4) Convert the following CFG to CNF (Chomsky Normal form).

a) Start symbol S

$$
\begin{aligned}
S &\to aAa \mid bBb \mid \epsilon \\
A &\to C \mid a \\
B &\to C \mid b \\
C &\to CDE \mid \epsilon \\
D &\to A \mid B \mid ab
\end{aligned}
$$

b) Start symbol S

$$
\begin{aligned}
S &\to AB \mid CA \\
A &\to a \\
B &\to BC \mid AB \\
C &\to aB \mid b
\end{aligned}
$$

c) Start symbol S

$$
\begin{aligned}
S &\to ASB \mid \epsilon \\
A &\to aAS \mid a \\
B &\to SbS \mid A \mid bb
\end{aligned}
$$

d) Start symbol S

$$
\begin{aligned}
S &\to 0A0 \mid 1B1 \mid BB \\
A &\to C \\
B &\to S \mid A \\
C &\to S \mid \epsilon
\end{aligned}
$$

e) Start symbol S

$$S \rightarrow AAA \mid B$$
$$A \rightarrow aA \mid B$$
$$B \rightarrow \epsilon$$

f) Start symbol S

$$S \rightarrow AB \mid CD$$
$$A \rightarrow BC \mid a$$
$$B \rightarrow AC \mid C$$
$$C \rightarrow AB \mid CD$$
$$D \rightarrow AC \mid d$$

g) S → aSb|b

CYK

Question -5)

Grammar	Strings to check
S → AB | BC A → BA | a B → CC | b C → AB | a	a) w = ababb b) w = baaba c) w = ababa d) w = baaab e) w = aabab f) w = ababaa

Question -6)

S_0 □ WB |b

S → WB |b
A → a
B → b
W → AS

String to check: **aabbbb**