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Question 1

a) $[X, Y \mid Z]$ and $[p, q, r, s, t \mid [u, v, Y]]$

R.H.S. = $[p, q, r, s, t, u, v, Y]$
= $[p, q \mid [r, s, t, u, v, Y]]$

$X = p$
 $Y = q$
 $Z = [r, s, t, u, v, Y]$

Therefore, the lists can be made identical.

b) $[a, [Y \mid [b, c]], d]$ and $[a, [b, [b, c]] \mid Z]$

L.H.S. = $[a, [Y \mid [b, c]] \mid [d]]$
R.H.S. = $[a, [b \mid [[b, c]] \mid Z]$

$Y = b$
 $Z = [d]$

But $[b, c]$ cannot match to $[[b, c]]$
Therefore, the lists cannot be made identical.

c) $[yyz \mid [yow \mid [yyc \mid [yvr \mid [yul \mid [YEG]]]]]]$ and $[A1, A2 \mid A3]$

= $[yyz \mid [yow \mid [yyc \mid [yvr \mid [yul, YEG]]]]]]$
= $[yyz \mid [yow \mid [yyc \mid [yvr, yul, YEG]]]]]$
= $[yyz \mid [yow \mid [yyc, yvr, yul, YEG]]]]$
= $[yyz \mid [yow, yyc, yvr, yul, YEG]]]$
= $[yyz, yow, yyc, yvr, yul, YEG]]$
= $[yyz, yow \mid [yyc, yvr, yul, YEG]]]$

$A1 = yyz$
 $A2 = yow$
 $A3 = [yyc, yvr, yul, YEG]$

Therefore, the lists can be made identical.

$$\begin{aligned}
 \text{d) } & [apple, Z, bee \mid [Z, car, door]] & [X \mid [bee, Y \mid [Q \mid R]]] \\
 & = [apple, Z, bee, Z, car, door] & \underbrace{X}_{\text{apples}} \quad \underbrace{Y}_{Z} \quad \underbrace{Q}_{car} \quad \underbrace{R}_{door} \\
 & = [apple, Z \mid [bee, Z, car, door]] \\
 & = [apple, Z \mid [bee, Z \mid [car, door]]] \\
 & = [apple, Z \mid [bee, Z \mid [car \mid [door]]]]
 \end{aligned}$$

$$X = \text{apple}, Y = Z, Q = \text{car}, R = \text{door}$$

\therefore cannot be made identical. there are two occurrences of $Y = Z$ in the first list, but only one occurrence in the second list.

$$\begin{aligned}
 \text{e) } & [z \mid [z \mid [z \mid [z]]]] \quad \text{and} \quad [b \mid Y] \\
 & = [z \mid [z \mid [z, [z]]]] & \underbrace{z}_{Z} \quad \underbrace{Y}_{Z}, [z, [z]] \\
 & = [z \mid [z, [z, [z]]]] & Z = b \\
 & = [z, z, [z, [z]]] \\
 & = [b, b, [b, [b]]] \\
 & \therefore \text{ can be made identical when } Z = b \text{ and } Y = b, [b, [b]]
 \end{aligned}$$

$$\begin{aligned}
 f) \quad [U \mid [W \mid [U]]] & \quad \text{and} \quad [the, quick, brown, fox, W] \\
 = [the \mid [quick \mid [brown]]] & \quad = [the \mid [quick, brown, fox, W]] \\
 & \quad = [the \mid [quick \mid [brown, fox, W]]] \\
 & \quad \quad \quad \underbrace{\hspace{1.5cm}}_{quick}
 \end{aligned}$$

$$U = the, W = quick, U = brown$$

\therefore cannot be made identical. The first list only accepts 3 elements while the second accepts 5 elements.

$$g) \quad [first \mid [U \mid [[R] \mid U]]] \text{ and } [Q, [], [Q] \mid U]$$

L.H.S.

$$= [first, U \mid [[R] \mid U]]$$

$$= [first, U, [R] \mid U]$$

$$Q = first$$

$$R = first$$

$$Q = R$$

$$U = []$$

R.H.S.

$$[Q, [], [Q] \mid U]$$

$$= [first, U, [R] \mid U]$$

Since L.H.S. = R.H.S., the lists can be made identical.

h)

L.H.S.

```
[ Did | [ [ An, X ] | [ ever, Win, An, X ] ] ]  
= [ Did, [ An, X ] | [ ever, Win, An, X ] ]  
= [ Did, [ An, X ], ever, Win, An, X ]  
= [ Did, [ hammerstein, TheSecond ], ever, Win, An, oscar ]
```

```
Where,  An = hammerstein,  
        X = TheSecond,  
        X = oscar
```

R.H.S.

```
[ Only, [ One, oscar ] | [ Did, X, hammerstein, TheSecond ] ]  
[ Only, [ One, oscar ], Did, X, hammerstein, TheSecond ]  
= [ Did, [ hammerstein, TheSecond ], ever, Win, An, oscar ]
```

```
Where,  
Only = Did,  
One = hammerstein,  
oscar = TheSecond,  
Did = ever,  
X = Win,  
hammerstein = An,  
TheSecond = oscar
```

Identitcal variables are:

```
Only = Did = ever  
An = One = hammerstein  
X = Win = TheSecond = oscar
```

Since L.H.S. = R.H.S., the lists can be made identical.