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Problem For Practice

1)Write a program to check the validity of Modus Tollens.

```
In[3]:= T = BooleanTable[{p, q, Equivalent[(! p && (p → q)) = ! p]}]  
Grid[Prepend[T, {"p", "q", "(!p&&(p→q))=!p"}], Frame → All, Dividers → All]  
Out[3]:= {{True, True, True}, {True, False, True}, {False, True, True}, {False, False, True}}
```

p	q	(!p&&(p→q))=!p
True	True	True
True	False	True
False	True	True
False	False	True

2)Write a program to show that SvR is Tautologically implied by $(P \vee Q) \wedge (P \rightarrow R) \vee (Q \rightarrow S)$.

```
T = BooleanTable[{p, q, r, s, Equivalent[(((p || q) && (p → q) || (q → s)) = (s || r))]}]  
Grid[Prepend[T, {"p", "q", "r", "s", "(((p||q)&&(p→q)||(q→s))=(s||r))"}],  
Frame → All, Dividers → All]
```

p	q	r	s	(((p q)&&(p→q) (q→s))=(s r))
True	True	True	True	True
True	True	True	False	True
True	True	False	True	True
True	True	False	False	True
True	False	True	True	True
True	False	True	False	True
True	False	False	True	True
True	False	False	False	True
False	True	True	True	True
False	True	True	False	True
False	True	False	True	True
False	True	False	False	True
False	False	True	True	True
False	False	True	False	True
False	False	False	True	True
False	False	False	False	True

3)Generate the truth table to check the validity of the arguments, "If there was rain, then travelling was difficult. If they had an umbrella, then travelling was not difficult. They had an umbrella. Therefore there was no rain."

Let

p=There was Rain.

q=Travelling was difficult.

r=They had Umbrella.

```
In[3]:= T = BooleanTable[{p, q, r, !p, !q, Equivalent[[(p → q) || (r → !q) && r] = !p]]]
Grid[Prepend[T, {"p", "q", "r", "!p", "!q", "((p→q)|| (r→!q)&&r)=!p"}],
      Frame → All, Dividers → All]
```

 **Set:** Tag Or in $(p \rightarrow q) \parallel ((r \rightarrow !q) \&\& r)$ is Protected.

```
Out[3]= {{True, True, True, False, False, True}, {True, True, False, False, False, True},
         {True, False, True, False, True, True}, {True, False, False, False, True, True},
         {False, True, True, True, False, True}, {False, True, False, True, False, True},
         {False, False, True, True, True, True}, {False, False, False, True, True, True}}
```

Out[4]=

p	q	r	!p	!q	$((p \rightarrow q) \parallel (r \rightarrow !q) \&\& r) = !p$
True	True	True	False	False	True
True	True	False	False	False	True
True	False	True	False	True	True
True	False	False	False	True	True
False	True	True	True	False	True
False	True	False	True	False	True
False	False	True	True	True	True
False	False	False	True	True	True

4)Generate The truth table to check the validity of the arguments, "If 7 is less than 4, then 7 is not a prime number. 7 is not less than 4, therefore 7 is a prime number."

Let

p=7 is less than 4.

q=7 is a prime number.

```
In[5]:= T = BooleanTable[{p, q, !p, !q, Equivalent[ $((p \rightarrow !q) \&\&!p) = q$ ]}]
Grid[Prepend[T, {"p", "q", "!p", "!q", " $((p \rightarrow !q) \&\&!p) = q$ "}, Frame → All, Dividers → All]
```

```
Out[5]:= {{True, True, False, False, True}, {True, False, False, True, True},
{False, True, True, False, True}, {False, False, True, True, True}}
```

```
Out[6]=
```

p	q	!p	!q	$((p \rightarrow !q) \&\&!p) = q$
True	True	False	False	True
True	False	False	True	True
False	True	True	False	True
False	False	True	True	True

5. Generate the truth table to check the validity of the arguments, "In a triangle xyz, there is no pair of angles of equal measure. If a triangle has two sides of equal lengths, then it is isosceles. If a triangle is isosceles, then it has two angles of equal measure. Hence triangle xyz has no two sides of equal lengths."

Let

p = no pair of equal measures.

q = triangle has two equal sides.

r = is an isosceles triangle.

```
In[13]:= T = BooleanTable[{p, q, r, !p, Equivalent[ $((q \rightarrow r) \&\&(r \rightarrow !p)) = p$ ]}]
Grid[Prepend[T, {"p", "q", "r", "!p", " $((q \rightarrow r) \&\&(r \rightarrow !p)) = p$ "}, Frame → All, Dividers → All]
```

```
Out[13]=
```

```
{{True, True, True, False, True}, {True, True, False, False, True},
{True, False, True, False, True}, {True, False, False, False, True},
{False, True, True, True, True}, {False, True, False, True, True},
{False, False, True, True, True}, {False, False, False, True, True}}
```

```
Out[14]=
```

p	q	r	!p	$((q \rightarrow r) \&\&(r \rightarrow !p)) = p$
True	True	True	False	True
True	True	False	False	True
True	False	True	False	True
True	False	False	False	True
False	True	True	True	True
False	True	False	True	True
False	False	True	True	True
False	False	False	True	True