Practical 6

Finding the following for a given Boolean polynomial function:
Q1. Representation of Boolean polynomial function and finding its value when the Boolean variables in it
take particular values over the Boolean algebra {0,1}.

Representing Boolean Functions

1. f(x,y,z)= xy + yz + zx

In[3]:=
```
f[x_, y_, z_] := (x ∧ y) ∨ (y ∧ z) ∨ (z ∧ x);
f[p, q, r]
```
Out[4]=
```
(p && q) || (q && r) || (r && p)
```
In[5]:=
```
f[True, False, True]
```
Out[5]=
```
True
```
In[6]:=
```
f[True, q, r]
```
Out[6]=
```
q || (q && r) || r
```
In[7]:=
```
f[True, q, r] // Simplify
```
Out[7]=
```
q || r
```

2.g(x,y)=!(!(x+y)x+!!!y)+xy+x!y

In[8]:=
```
g[x_, y_] := !((!(x ∨ y) ∧ x) ∨ !!! y) ∨ (x ∧ y) ∨ (x ∧ ! y)
g[False, False]
```
Out[9]=
```
False
```
In[10]:=
```
g[False, True]
```
Out[10]=
```
True
```
In[11]:=
```
g[True, False]
```
Out[11]=
```
True
```
In[12]:=
```
g[True, True]
```
Out[12]=
```
True
```

3. h(x,y,z)=x(!(y+z))+(xy+!z)x

In[6]:=
```
h[x_, y_, z_] := (x ∧ (! (y ∨ z)) ∨ ((x ∧ y) ∨ ! z) ∧ x);
h[0, 0, 0] // Simplify
```
Out[7]=
```
False
```
In[8]:=
```
h[1, 0, 0] // Simplify
```
Out[8]=
```
True
```
In[9]:=
```
h[0, 1, 0] // Simplify
```
Out[9]=
```
False
```
In[10]:=
```
h[0, 0, 1] // Simplify
```
Out[10]=
```
False
```
In[11]:=
```
h[1, 1, 0] // Simplify
```
Out[11]=
```
True
```
In[12]:=
```
h[0, 1, 1] // Simplify
```
Out[12]=
```
False
```
In[13]:=
```
h[1, 0, 1] // Simplify
```
Out[13]=
```
False
```
In[15]:=
```
h[1, 1, 1] // Simplify
```
Out[15]=
```
True
```

Q 2 . Display in table form of all possible values of Boolean polynomial function over the Boolean algebra {0,1}

Table Form

1. For Boolean expression f:

In[1]:=
```
BooleanTable[{p, q, r, f[p, q, r]}, {p, q, r}] // TableForm
```

Out[1]//TableForm=

True	True	True	f[True, True, True]
True	True	False	f[True, True, False]
True	False	True	f[True, False, True]
True	False	False	f[True, False, False]
False	True	True	f[False, True, True]
False	True	False	f[False, True, False]
False	False	True	f[False, False, True]
False	False	False	f[False, False, False]

In[2]:=
```
Boole[BooleanTable[{p, q, r, f[p, q, r]}, {p, q, r}]] // TableForm
```

Out[2]//TableForm=

1	1	1	Boole[f[True, True, True]]
1	1	0	Boole[f[True, True, False]]
1	0	1	Boole[f[True, False, True]]
1	0	0	Boole[f[True, False, False]]
0	1	1	Boole[f[False, True, True]]
0	1	0	Boole[f[False, True, False]]
0	0	1	Boole[f[False, False, True]]
0	0	0	Boole[f[False, False, False]]

In[4]:=
```
TableForm[Boole[BooleanTable[{p, q, r, f[p, q, r]}, {p, q, r}]],
 TableHeadings → {None, {p, q, r, f}}]
```

Out[4]//TableForm=

p	q	r	f
1	1	1	Boole[f[True, True, True]]
1	1	0	Boole[f[True, True, False]]
1	0	1	Boole[f[True, False, True]]
1	0	0	Boole[f[True, False, False]]
0	1	1	Boole[f[False, True, True]]
0	1	0	Boole[f[False, True, False]]
0	0	1	Boole[f[False, False, True]]
0	0	0	Boole[f[False, False, False]]

2. For Boolean expression g:

In[5]:=
```
TableForm[Boole[BooleanTable[{p, q, g[p, q]}, {p, q}]], TableHeadings → {None, {p, q, g}}]
```

Out[5]//TableForm=

p	q	g
1	1	Boole[g[True, True]]
1	0	Boole[g[True, False]]
0	1	Boole[g[False, True]]
0	0	Boole[g[False, False]]

3. For Boolean expression h:

```
In[6]:= TableForm[Boole[BooleanTable[{p, q, r, h[p, q, r]}, {p, q, r}]],
         TableHeadings → {None, {p, q, r, h}}]
```

Out[6]//TableForm=

p	q	r	h
1	1	1	Boole[h[True, True, True]]
1	1	0	Boole[h[True, True, False]]
1	0	1	Boole[h[True, False, True]]
1	0	0	Boole[h[True, False, False]]
0	1	1	Boole[h[False, True, True]]
0	1	0	Boole[h[False, True, False]]
0	0	1	Boole[h[False, False, True]]
0	0	0	Boole[h[False, False, False]]