**Problem No: 1**

**Topic: Propositional Logic**

**Problem Title:**

Generate Truth Table for the propositional value of p and q find the negation of p and q, conjunction (p ∧ q), disjunction (p ∨ q), Exclusive OR (p ⊕ q), Conditional Statement (p 🡪 q), Bi-conditional (p ↔ q) Statement.

**Objectives:**

To learn about negation, conjunction, disjunction, Exclusive OR, Conditional Statement, Bi-conditional Statement.

**Source Code:**

#include <iostream>

using namespace std;

int main()

{

int p, q;

cout << "p" << "\t" << "q" << "\t" << "!p\t" << "!q\t" << "p && q"

<< "\t" << "p || q" << "\t" << "p ^ q"

<< "\t" << "p -> q" << "\t" << "q -> p"

<< "\t" << "p <-> q" << endl << endl;

for(p = 0; p <= 1; p++){

for(q = 0; q <= 1; q++){

bool a = p && q;

bool b = p || q;

bool c = p ^ q;

bool d = !p || q;

bool e = !q || p;

bool f = d && e;

cout << p << "\t" << q << "\t" << !p << "\t" << !q << "\t " << a << "\t "

<< b << "\t " << c << "\t " << d << "\t "

<< e << "\t " << f << endl;

}

}

cout << endl;

}

**Output:**

p q !p !q p && q p || q p ^ q p -> q q -> p p <-> q

0 0 1 1 0 0 0 1 1 1

0 1 1 0 0 1 1 1 0 0

1 0 0 1 0 1 1 0 1 0

1 1 0 0 1 1 0 1 1 1

Process returned 0 (0x0) execution time : 0.048 s

Press any key to continue.

**Problem No: 2**

**Topic: Propositional Logic**

**Problem Title:**

Generate Truth Table for Compound Proposition p ∨ q 🡪 !r

**Objectives:**

To learn about Compound propositions.

**Source Code:**

#include <iostream>

using namespace std;

int main()

{

int p, q, r;

cout << "p\t" << "q\t" << "r\t" << "!r\t" << "p || q\t"

<< "(p || q) -> !r" << endl;

for(p =0; p < 2; p++){

for(q = 0; q < 2; q++){

for(r = 0; r < 2; r++){

bool a = p || q;

bool b = !a || !r;

cout << p << "\t" << q << "\t" << r << "\t"

<< !r << "\t " << a << "\t " << b << endl;

}

}

}

}

**Output:**

p q r !r p || q (p || q) -> !r

0 0 0 1 0 1

0 0 1 0 0 1

0 1 0 1 1 1

0 1 1 0 1 0

1 0 0 1 1 1

1 0 1 0 1 0

1 1 0 1 1 1

1 1 1 0 1 0

Process returned 0 (0x0) execution time : 0.051 s

Press any key to continue.

**Problem No: 3**

**Topic: Propositional Logic**

**Problem Title:**

Given the Propositional Value for p, q and r, now check two given compound proposition are equivalent or not (i.e. ⌐(p∧q)∧ r and ⌐p∨ ⌐q∧ r are logical equivalent or not).

**Objectives:**

To learn whether two compound propositions are equivalent or not.

**Theory:**

Two propositions are equivalent if they always have the same truth value.

**Source Code:**

#include <iostream>

using namespace std;

int main()

{

int p, q, r;

cout << "p\t" << "q\t" << "r\t" << "!p\t" << "!q\t" << "!r\t" << "p && q\t"

<< " (!p || !q)\t" << "!(p && q) && r\t" << "(!p || !q) && !r" << endl << endl;

for(p =0; p < 2; p++){

for(q = 0; q < 2; q++){

for(r = 0; r < 2; r++){

bool a = p && q;

bool b = !a && r;

bool c = (!p || !q);

bool d = c && r;

cout << p << "\t" << q << "\t" << r << "\t" << !p << "\t" << !q << "\t"

<< !r << "\t " << a << "\t " << c << "\t\t " << b << "\t\t " << d << endl;

}

}

}

cout << "!(p && q) && r == (!p || !q) && !r" << endl;

}

**Output:**

p q r !p !q !r p && q (!p || !q) !(p && q) && r (!p || !q) && !r

0 0 0 1 1 1 0 1 0 0

0 0 1 1 1 0 0 1 1 1

0 1 0 1 0 1 0 1 0 0

0 1 1 1 0 0 0 1 1 1

1 0 0 0 1 1 0 1 0 0

1 0 1 0 1 0 0 1 1 1

1 1 0 0 0 1 1 0 0 0

1 1 1 0 0 0 1 0 0 0

!(p && q) && r == (!p || !q) && !r

Process returned 0 (0x0) execution time : 0.063 s

Press any key to continue.