Truth Table in C

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2018-03-12 Mon

Outline

Logical Equivalence Example (1)

```c
#include <stdio.h>

#define p u.a.P
#define q u.a.Q
#define r u.a.R

#define n (1<<3)

struct atom {
  unsigned R:1;
  unsigned Q:1;
  unsigned P:1;
} ;

union utype {
  struct atom  a;
  int i;
} ;
```

```c
int main(void) {

  int i;
  union utype u;

  for (i=n-1; i>=0; --i) {
    u.i = i;
    printf("p=%d q=%d r=%d \n", p, q, r);
  }
  printf("\n");

  for (i=n-1; i>=0; --i) {
    u.i = i;
    printf("(%d,%d,%d)  ", p, q, r);
    printf("q&r=%d p|(q&r)=%d   ", q&r, p|(q&r));
    printf("p|q=%d p|r=%d ", p|q, p|r);
    printf("(p|q)&(p|r)=%d \n", (p|q)&(p|r));
  }

}
```

```
p=1 q=1 r=1
p=1 q=1 r=0
p=1 q=0 r=1
p=1 q=0 r=0
p=0 q=1 r=1
p=0 q=1 r=0
p=0 q=0 r=1
p=0 q=0 r=0


(1,1,1)   q&r=1 p|(q&r)=1    p|q=1 p|r=1 (p|q)&(p|r)=1
(1,1,0)   q&r=0 p|(q&r)=1    p|q=1 p|r=1 (p|q)&(p|r)=1
(1,0,1)   q&r=0 p|(q&r)=1    p|q=1 p|r=1 (p|q)&(p|r)=1
(1,0,0)   q&r=0 p|(q&r)=1    p|q=1 p|r=1 (p|q)&(p|r)=1
(0,1,1)   q&r=1 p|(q&r)=1    p|q=1 p|r=1 (p|q)&(p|r)=1
(0,1,0)   q&r=0 p|(q&r)=0    p|q=1 p|r=0 (p|q)&(p|r)=0
(0,0,1)   q&r=0 p|(q&r)=0    p|q=0 p|r=1 (p|q)&(p|r)=0
(0,0,0)   q&r=0 p|(q&r)=0    p|q=0 p|r=0 (p|q)&(p|r)=0
```

Logical and Bitwise AND (1)

```c
#include <stdio.h>

int main(void) {

  unsigned char p = 0x46;
  unsigned char q = 0xE8;

  printf("logical AND \n");

  printf("1 means true \n");
  printf("  0 &&  0 = %d \n", 0 && 0);
  printf("  0 &&  1 = %d \n", 0 && 1);
  printf("  1 &&  0 = %d \n", 1 && 0);
  printf("  1 &&  1 = %d \n", 1 && 1);
  printf("\n");

  printf("non-zero value is considered as true \n");
  printf("  0 &&  0 = %d \n",  0 &&  0);
  printf("  0 && 11 = %d \n",  0 && 11);
  printf(" 22 &&  0 = %d \n", 22 &&  0);
  printf(" -1 &&  9 = %d \n", -1 &&  9);
  printf("\n");
```

```
logical AND
1 means true
  0 &&  0 = 0
  0 &&  1 = 0
  1 &&  0 = 0
  1 &&  1 = 1

non-zero value is considered as true
  0 &&  0 = 0
  0 && 11 = 0
 22 &&  0 = 0
 -1 &&  9 = 1

bitwise AND
 p & q = 40 64

logical and bitwise NOT
!p = 0 0
~p = fffffffb9 -71
```