MC140: lecture #15

today's topic:

logical operators
random numbers

logic in C.

- based on Boolean algebra
  - reduces logic to a simple algebra
  - invented by George Boole, 19th century British mathematician
- two values
  - TRUE (1)
  - FALSE (0)

logical operators.

- in C, there are 3 logical operators:

meaning	C operator
NOT	!
AND	&&
OR	||

- they are used for complementary and complex truth expressions
  - where a simple truth expression is: `( z == 'Q' )`
  - complement is: `!( z == 'Q' )`
  - complex example: `( z == 'Q' ) || ( z == 'q' )`

truth table.

- defines all combinations of TRUE and FALSE for a given logical operator
- for example:

NOT	FALSE	TRUE
	TRUE	FALSE

AND.

- only TRUE if both components of compound statement are TRUE
- truth table:

AND	FALSE	TRUE
FALSE	FALSE	FALSE
TRUE	FALSE	TRUE

OR.

- always TRUE unless both components of compound statement are FALSE
- truth table:

OR	FALSE	TRUE
FALSE	FALSE	TRUE
TRUE	TRUE	TRUE

from logic to C.

NOT	FALSE	TRUE
	TRUE	FALSE

!	0	1
	1	0

AND	FALSE	TRUE
FALSE	FALSE	FALSE
TRUE	FALSE	TRUE

&&	0	1
0	0	0
1	0	1

OR	FALSE	TRUE
FALSE	FALSE	TRUE
TRUE	TRUE	TRUE

||	0	1
0	0	1
1	1	1

truth table program.

```
#include <stdio.h>

#define TRUE  1
#define FALSE 0

int main( void ) {
   printf( "%d AND %d = %d\n", FALSE, FALSE, FALSE && FALSE );
   printf( "%d AND %d = %d\n", FALSE, TRUE,  FALSE && TRUE );
   printf( "%d AND %d = %d\n", TRUE,  FALSE, TRUE && FALSE );
   printf( "%d AND %d = %d\n", TRUE,  TRUE,  TRUE && TRUE );
   return( 0 );
} /* end of main() */
```


random numbers.

- with computers, nothing is random -- even though it may seem that way at times!
- there are two steps to using random numbers in C:
  (1) seeding the random number generator
  (2) generating random number(s)

random number generation.

- include library:
  `#include <stdlib.h>`
- seed function:
  `srand( time ( NULL ));`
- random number function:
  `int i = rand();`

random number program.

```
#include <stdio.h>
#include <stdlib.h>
#include <time.h>

int rollDice( void );

int main( void ) {
   int i, total=0;
   srand( time( NULL ));
   for ( i=0; i<10; i++ ) {
       total += rollDice();
   }
   printf( "average = %d\n",
           total/10 );
   return( 0 );
} /* end of main() */
```

```
int rollDice( void ) {
       int die1 = (rand()%6)+1;
       int die2 = (rand()%6)+1;
       printf( "player rolled %d and %d\n",
           die1,die2 );
       return( die1 + die2 );
} /* end of rollDice() */
```


reading.

- material covered today:
  - DD: 4.10, 5.9