

1st C Class with Mr. Czik

Question posed: How would you direct a humanoid robot to get you a bowl of cereal?

Answer: this list was worked out as an interactive exercise

Stand up	Take out milk
Walk into kitchen	Close refrigerator
Walk to bowl cabinet	Walk back to bowl
Open cabinet	Open milk
Take out bowl	Pour milk into bowl (don't overflow)
Put bowl on counter	Close milk
Close cabinet	Walk back to refrigerator
Walk to cereal cabinet	Open door
Open cabinet	Put milk into refrigerator
Take out cereal	Close door
Close cabinet	Walk to spoon drawer
Walk back to bowl	Open drawer
Open cereal box	Take out spoon
Pour cereal into bowl (don't overflow)	Close drawer
Close cereal box	Walk back to bowl
Put box onto counter	Put spoon into bowl
Walk to refrigerator	Pick up bowl
Open refrigerator	Bring bowl to table

Each step on this list would consist of many actual commands to the robot.

An example of procedural programming – steps in order (order is important!)

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C code can use Decisions/Tests and Repetition to change the code that is run in different circumstances

Decisions/Tests – if/else statement

```
if (condition1)
{
    Do something
}
else if (condition2)
{
    Do something else
}
else if (condition3)
{
    Do yet another thing
}
else
{
    Do this if all else fails
}
```

An example:

```
if (we see the cereal box)
{
    Grab the box
}
Else
{
    Keep looking
}
```

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```
int rotations = 0 . . . . . declares variable and
                        a starting value
if (rotations < 1)
{
    Procedure (1)
}
else if (rotations < 5)
{
    Procedure (2)
}
else if (rotations == 5) . . . . . tests for equality (==)
{
    Procedure (3)
}
else
{
    Procedure (4) . . . . . if all else fails . . .
}
}
```

Must declare type of variables in C– char, int, long, float

Type	Min Value	Max Value	Memory Size	Speed for basic operations
char	-128	128	1 byte	Very Fast
int	-32768	32767	2 bytes	Fast
long	-2147483648	2147483647	4 bytes	Average
float	Negatively Virtually infinite	Virtually infinite	4 bytes	Painfully slow

char for alphanumeric or small range of integer numbers
(8 bits = 256 maximum number of values)

int for medium range integer numbers (16 bits = 65536)

long for large range integer numbers (32 bits = 4294967296)

float works with fractional numbers, should be avoided for real-time control work, as it is WAY too slow)

Decision/Test with iteration/repetition – while statement

```
while (condition)
{
    Do this
}
```

While loops are used primarily when the number of iteration is unknown, repeating until a condition is met.

```
int rotations = 0;
while (rotations < 5) . . . . . 5 loops 5 (i = 0,1,2,3,4)
{
    Rotate (1);
    Rotations ++; . . . . . increments by 1
}
rotations = 0; . . . . . resets i to 0
```

```
int i = 0
while (i < 10)
{
    Printf ("I is %d\n", i); . . . . . prints to screen "i is 0"
    i ++; . . . . . through "i is 9"
}
```

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Decision/Test with iteration/repetition – for statement

```
for (initialization; condition; iteration)
{
    Do this
}
```

For loops are used primarily when you have a set of known values, repeating a specific number of times.

```
int i; . . . . . This is the same as the last
while loop
```

```
for (i = 0; i < 10; i ++ )
{
    ("I is %d\n", i);
}
```

```
int i;
```

```
for (i = 0; i < 32; i + 8) . usually you increment from 0
{
    dothisfunction(i) . This function will run 4 times,
                        with i = 0, 8, 16, & 24)
}
```

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C programs start with main

```
main (void)
{
    int i

    for (i = 0, i < 10, i ++ )
        {
            Rotate (i);
        }
}
```

This is an entire main C routine. It will call the function Rotate 10 times, passing the value i (equal to 0 – 9) each time.

Libraries of code can be included in the C program, when the program is compiled. An include statement will specify a header file (as in most things in C, the name is case-sensitive). Header files end in the extension .h, and C code files end in the extension .c .

```
# include "WPILib.h"
Void main(void)
{
    WPIInitialize();
    TwoWheelDrive (1,2);
    wait (1500)
    while (1)
    {
        Drive (PWMin(2), PWMin(1));
        wait (20)
    }
}
```

This is a C program example, using the code libraries written for the WPI "Savage Soccer" competition. It sets the 2-wheel drive system up for remote radio control.