Spring 2013 - CSE 325: Embedded Microprocessor Systems

Project 1: Bit Manipulation Functions

Points: 5, Due Date: Jan 28, 2013

1. Bit Manipulation

Typical operations, like addition, subtraction work on a bunch of bits, like a word, double etc. However, at many places we need to manipulate the bits of values.

Bitwise operators work on bits and perform bit by bit operation.

Assume if uchar B = 60; and uchar B = 13; Now in binary format they will be as follows:

A = 0011 1100

B = 0000 1101

A&B = 0000 1100

A|B = 0011 1101

A^B = 0011 0001

~A = 1100 0011

There are 6 bit manipulation numbers in C/C++.

Operator	Description	Example
&	Binary AND Operator copies a bit to the result if it exists in both operands.	(A & B) will give 12 which is 0000 1100
|	Binary OR Operator copies a bit if it exists in eather operand.	(A | B) will give 61 which is 0011 1101
^	Binary XOR Operator copies the bit if it is set in one operand but not both.	(A ^ B) will give 49 which is 0011 0001

~	Binary Ones Complement Operator is unary and has the effect of 'flipping' bits.	(~A) will give -60 which is 1100 0011
<<	Binary Left Shift Operator. The left operands value is moved left by the number of bits specified by the right operand.	A << 2 will give 240 which is 1111 0000
>>	Binary Right Shift Operator. The left operands value is moved right by the number of bits specified by the right operand.	

In this assignment you have to write the following functions:

```
typedef int CF_LONGWord;
typedef uchar CF_Byte;
typedef short CF_Word;

void setBit(CF_LONGWord &number, int pos);
      Sets the bit at position “pos” in CF_LONGWord “number”.

void clearBit(CF_LONGWord &number, int pos);
      Clears the bit at position “pos” in CF_LONGWord “number”.

void setBit(CF_LONGWord &number, int pos, bool value);
      Sets the bit at position “pos” in CF_LONGWord “number” to Boolean value
“value”.

bool getBit(CF_LONGWord number, int pos);
      Returns the value of the bit at position “pos” in CF_LONGWord “number”.

CF_LONGWord getBits(CF_LONGWord number, int hpos, int lpos);
      Returns the value of bits from “hpos” to “lpos” in CF_LONGWord “number”.

void setBits(CF_LONGWord &number, int hpos, int lpos, CF_LONGWord value);
      Sets the bits from “hpos” to “lpos” in integer “number” to value “value”.

CF_Byte getByte(CF_LONGWord number, int pos);
      Returns the byte at position “pos” in number “number”.

CF_Word getWord(CF_LONGWord number, int pos);
      Returns the word at position “pos” in number “number”.

Void setByte(CF_LONGWord &number, int pos, CF_Byte value);
      Sets the byte at position “pos” in number “number” to value “value”.
```

```
void setWord(CF_LONGWord &number, int pos, CF_Word value);
      Sets the word at position “pos” in number “number” to value “value”.
```

Write these functions for both big-endian computer system, and a little-endian computer system.

After you write these functions, test these functions for all cases. We will use an automated testbench to evaluate your submission. You can submit the assignment including the testbench, but we will use our own test bench to grade the assignment.

2. Submission Instructions

Submit a “C” file with these functions. At the top of the file, in comments, write

(1) Your name and your partner's name if you worked with someone else;

(2) Course number and name, i.e., CSE325 Embedded Microprocessor Systems;

(3) Semester, i.e., Spring 2013;

(4) Lab project number, e.g., Lab Project 1;

(5) Effort division between the team members, e.g., team member 1: 40%, team member 2: 60%.

Submit this document on the blackboard.

Late submissions WILL NOT be accepted