Lab 3 (100 pts) – MIPS Operations

Complete by yourself

Release date: 18 September 2006
Due date: One week following lab

1. **[40 pts] Base conversion.** Write a program in MIPS to convert between bases. *Input bases:* 2-16. *Output bases:* 2-16.

For this part of the assignment, you are required to write a MIPS assembly program to convert an unsigned integer *u* in base *b* into its base *d* equivalent. The following are the tasks to complete this part:

1. Accept a base *b* as an input.
2. Accept an unsigned integer *u* in base *b*.
3. Accept a target base *d* as an input.
4. Convert *u* into its base *d* equivalent.
5. Display the base *d* number onto the console.

**Example.**

Input base: 12
Input number in base 12: 12ab85
Convert to base? 16
Base 16 equivalent: ...

Assume that all inputs are well-formed, i.e. all numbers are within their legal ranges.

2. **[25 pts] Jump table.** Translate the given C program into its MIPS assembly equivalent. Use *jump address tables* to implement the switch-case statements.

```c
int A[12] = {108,102,106,104,112,100,110,102,102,98,100,0};
void main(){
    int i =0;
    while(A[i]!=0){
        switch(A[i]){
            case 100: B[i] = B[i] * B[i]; break;
            case 102:
            case 104: B[i] = B[i] - 20; break;
```
case 106: B[i] = B[i]/2; break;
case 108: break;
default: printf("Number out of range!");
}
printf("B[%d]=%d\n", i, B[i]);
i++;
}

3. [35 pts] Multidimensional arrays. Write a MIPS assembly program to multiply two 3x3 matrices, A and B, and store the result into a matrix C. Note: Memory for the matrices should be defined statically in the .data section of your code and the data should be stored in a column major format, i.e. the matrix

\[
\begin{pmatrix}
a_{00} & a_{01} & a_{02} \\
a_{10} & a_{11} & a_{12} \\
a_{20} & a_{21} & a_{22}
\end{pmatrix}
\]

is stored as the sequence \((a_{00}, a_{10}, a_{20}, a_{01}, a_{11}, a_{21}, a_{02}, a_{12}, a_{22})\).

The following are the tasks to complete this part:

1. Multiply the two matrices A and B, store the result in C.
2. Display the product matrix C on the console. (Verify the result by working out the solution.)