CPSC 321:501-503 - Computer Architecture
Texas A&M University
Department of Computer Science

Fall 2006

Lab 3 (100 pts) – MIPS Operations
Complete by yourself

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

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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.

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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.

```
int A[12] = {108,102,106,104,112,100,110,102,102,98,100,0};
int B[12] = {23,65,23,64,134,36,15,45,21,53,15,15};
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;
                case 110: B[i] = B[i] + 62; break;
                default: printf("Number out of range!");
            }
            printf("B[%d]=%d\n",i,B[i]);
            i++;
        }
    }
```

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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

$$\begin{matrix} a00 & a01 & a02 \\ a10 & a11 & a12 \\ a20 & a21 & a22 \end{matrix}$$

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.)
