國立清華大學資訊工程學系

計算機結構

2021 Fall Assignment 3

Deadline: 2021.11.07 23:59

- Those two exercises are to practice procedure call and recursive call.

Q1: Write a MIPS assembly program for the following C program.

```
#include <stdio.h>
#include <math.h>

int add(int, int);
int mmod(int, int);

int main(){
	int a, b, c, d;
	printf("input a: ");
	scanf("%d", &a);
	printf("input b: ");
	scanf("%d", &b);
	printf("input c: ");
	scanf("%d", &c);
	d = mmod(add(a, b), c);
	printf("result = %d\n", d);
	return 0;
}

int add(int x, int y){
	return x + y;
}

int mmod(int x, int y){
	int divisor;
	int dividend;
	divisor = x > y ? pow(2, (y % 4)) : pow(2, (x % 4));
	dividend = x > y ? x : y;
	return dividend % divisor;
}
```

P.S. a, b, c, d are stored in $s0, $s1, $s2, $s3 respectively.
And you must use the procedure (function) call to implement mmod and add. Also, your program should terminal normally (the output should show “-- program is finished running --“).

Output format example:

```
input a: 4
input b: 23
input c: 7
result = 3
```

Q2: Write a MIPS assembly program for the following C program.

```
#include <stdio.h>

int fn(int, int);
int re(int);

int main(){
	int a, b, c;
	printf("input a: ");
	scanf("%d", &a);
	printf("input b: ");
	scanf("%d", &b);
	c = fn(a, b);
	printf("ans: %d\n", c);
	c += re(a);
	printf("ans: %d\n", c);
	return 0;
}

int fn(int x, int y){
	if(x <= 0)
		return 0;
	else if(y <= 0)
		return 0;
	else if(x < y)
		return 1;
	else
		return fn(x - 1, y) + 2 * fn(x,  y + 2) + y;
```

```
}

int re(int x){
        return (x > 0) ? 1 + re(x - 1) : 0;
}
```

P.S. a, b, c are stored in $s0, $s1, $s2 respectively.

Output format example:

```
input a: 3
input b: 1
ans: 19
ans: 22
```

- **Bonus**

The operations given above contain modulo and multiplication. In some specific conditions, we can complete the operation without using “div” and “mul” instruction. Try it!

- **Submission (2 assembly programs)**

Please name your assembly program with your student ID, for example: “arch_hw3_p1_100000001.asm” & “arch_hw3_p2_100000001.asm”.
Use the eeclass (https://eeclass.nthu.edu.tw/) to submit your program.

- **Grading Criteria**

Correctness: 80%
Comment in program: 10%
Output format: 10%
Bonus: 5%