

## Lab 10: review

### Question 1:

Write a MIPS program with the following requirements:

1. Declare an array that can store 8 data elements.
2. Request integers from the user and store them into the array.
3. Check whether each element in the array is divisible by 3.
4. If an element is divisible by 3, divide it by 3.
5. If an element is not divisible by 3, change it to the number divisible by 3 that is closest to it, i.e, if the number is 32, the result will be 33.
6. Print the final array to the terminal.

### Question 2:

Using the same result as **question 1**, write a MIPS program to find the second largest element in a 15-elements array. If the array has more than one second largest element, find all their indexes. Print the value and all of its indexes. For example, if the array is 1, 2, 7, 7, 3, 7, 4, 5, 6, 7, 7, 8, 8, 8, 7 the output should be Second largest value is 7, found in index 2, 3, 5, 9, 10, 14.

### Question 3:

Write a MIPS program to check if the elements of a 10-elements array are unique (appears only once in the array). If there are duplicated values in the array, print those values. For example, if the array is 1, 2, 3, 3, 3, 1, 7, 8, 9, 10 then the output should be Unique values: 2, 7, 8, 9, 10. Duplicated value: 3, repeated 3 times; 1, repeated 2 times.

### Question 4:

Write a MIPS program that calculates and print either the volume or total surface area of a rectangular box, cube, cylinder or rectangular pyramid. The user is able to choose which metric, shape, and the related parameters to calculate. **Note that the parameters can be floating-point numbers.**

### Question 5:

Write a MIPS program to calculate the following integral:

$$f(x) = \int_v^u \frac{ax^4 + bx^3 + cx^2 + d}{e^2} \quad (1)$$

where u, v, a, b, c, d are floating-point numbers chosen by the user, and e is last digit of your student ID (for example, if your student ID is 1234567 then e is 7) For example, if you have the ID 1234567, and user inserted **a=1, b=2, c=3, d=4, u=5, and v=6** then the result should be: **-27.77**

### Question 6:

In this exercise, students are required to write a recursive program although the problem can be solved by iterations. Write a MIPS program that calculates the sum of all 10 elements in a single precision floating point array with synthetic data. Bellow is pseudo code of the recursive version:

```
float sum(float *v, int k){
    if (k == 1) return v[0];
    return v[0] + sum(&v[1], k-1);
}
```

### Question 7:

Taking the same requirements in Question 6, write a MIPS program that is able to find the maximum elements in an array. Bellow is pseudo code of the recursive version:

```
float max(float *v, int k){
    if (k == 1) return v[0];
    float temp = max(&v[1], k - 1);
    if (v[0] >= temp) return v[0];
    else return temp;
}
```