

Do not copy and paste the code. All the submissions in the lab have to be created manually. The paper version (if distributed) should be returned in class with the name and the student ID. The final result should be uploaded on D2L using lab05.txt.

Name: _____ Student ID: _____ Class: _____

Instructor: Jong-Kyou Kim, PhD _____

1. Answer to the following questions.

- (a) The following program computes $\sqrt{2}$ using C on Linux. Submit the source code with the name `lab05a.c`

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

int main() {
    double x = 2;
    double y = sqrt(x);
    printf("sqrt(2) = %lf\n", y);
}
```

- (b) The following program compiles the source code `lab05a.c`. Show the output of the program.

```
$ gcc lab05a.c -lm
```

2. Answer to the following questions.

- (a) The following source code defines a two-dimensional vector type. Submit the source code with the name `vector2.h`

```
struct vector2 {
    double x,y;
};

int vector2_add(struct vector2* v1, struct vector2* v2);
int vector2_print(struct vector2 v);
```

- (b) The following source code defines two operations for the two-dimensional vector type. Submit the source code with the name `vector2a.c`

```
#include <stdio.h>
#include "vector2.h"

int vector2_add(struct vector2* v1, struct vector2* v2) {
    v1->x += v2->x;
    v1->y += v2->y;
    return 0;
}
```

```

    }

    int vector2_print(struct vector2* v) {
        printf("(%lf,%lf)\n", v->x, v->y);
        return 0;
    }

```

- (c) The following source code defines two vectors $\mathbf{v}_1 = (1, 2)$, $\mathbf{v}_2 = (3, 4)$ and computes the following computation. Submit the source code with the name `lab05b.c`

$$v_1 = v_1 + v_2$$

```

#include "vector2.h"

int main() {
    struct vector2 v1, v2;
    v1.x = 1;
    v1.y = 2;
    v2.x = 3;
    v2.y = 4;
    vector2_add(&v1, &v2);
    vector2_print(&v1);
}

```

- (d) The following program compiles the source codes and produces the output named `a.out`. Show the output of the program.

```
$ gcc lab05b.c vector2.c
```

- (e) The following program extends the definition of `vector2` to compute the size of a vector, i.e., $|\mathbf{v}|$. Submit the source code with the name `lab05c.c`

```

#include "vector2.h"
#include <stdio.h>
#include <math.h>

double vector2_norm(struct vector2* v) {
    double x = v->x;
    double y = v->y;
    return sqrt(x*x + y*y);
}

int main() {
    struct vector2 v1, v2;
    double y;
    v1.x = 1;
    v1.y = 2;
    v2.x = 3;
    v2.y = 4;
    vector2_add(&v1, &v2);
    y = vector2_norm(&v1);
    printf("The size of the added vector is %lf\n", y);
}

```

- (f) The following program implements vector subtraction defined as the following.

$$v_1 = v_1 + v_2$$

```
#include "vector2.h"
#include <stdio.h>
#include <math.h>

double vector2_norm(struct vector2* v) {
    double x = v->x;
    double y = v->y;
    return sqrt(x*x + y*y);
}

int vector2_sub(struct vector2* v1, struct vector2* v2) {
    _____
    _____

    return 0;
}

int main() {
    struct vector2 v1, v2;
    double y;
    v1.x = 5;
    v1.y = 6;
    v2.x = 2;
    v2.y = 2;
    vector2_sub(&v1, &v2);
    vector2_print(&v1);
    y = vector2_norm(&v1);

    printf("The size of the substracted vector is %lf\n", y);
}
```

The output of the following program is as the following. Complete the program and submit the source code with the name lab05d.c

```
(3.000000,4.000000)
The size of the substracted vector is 5.000000
```