

CSSE 332 -- OPERATING SYSTEMS

C Review

Name:

SOLUTION KEY

Question 1. (5 points) Microcontrollers are often much more resource constrained than general-purpose devices, and thus run on a 16-bit CPU architecture. What is the pointer size (in bytes) on such devices?

Solution: 2 bytes.

Question 2. (5 points) Consider a piece code in which a static array `A` is declared as `int A[5];`. What is the initial value of `A[0]`?

Solution: Cannot know since there are no guarantees on the content of memory.

Question 3. Consider the following definition of the `element` and `container` structures:

```
1 struct element {  
2     int id;  
3     int cost;  
4     char *name;  
5 };  
6  
7 struct container {  
8     int num_elements;           // the number of elements  
9     struct element *elements;  // the elements array  
10};
```

(a) (5 points) Write down the syntax used to allocate an array (call it `arr`) of 20 container structures.

Solution: `struct container *arr = malloc(20 * sizeof(struct container));`

- (b) (5 points) Assume that the array above has already been created, what is the outcome of executing the following statement:

```
1 int c = arr->elements[0].cost;  
2 printf("%d", c);
```

Solution: Most likely a segmentation fault as `arr->elements` has not been allocated.

Question 4. (5 points) Consider an array of integers created on the heap using

```
int *array = malloc(10 * sizeof(int));
```

Which of the following expressions can be used to access the **sixth** element of the array?

- A. `*array + 5`
- B. `*array + 6`
- C. `*(array + 5)`
- D. `*(array + 6)`
- E. `*(array + 6*sizeof(int))`
- F. `*(array + 5*sizeof(int))`

Question 5. Consider a pointer to a custom structure (defined elsewhere) declared as

```
struct cool_struct *p;
```

- (a) (5 points) If we add 5 to p (i.e., do something like `q = p + 5;`), by how many bytes will q be away from p? `5 * sizeof(struct cool_struct)`
- (b) (10 points) We would like to move p exactly **16** bytes forward and then read the following 4 bytes as an integer. Suggest a way to achieve that using pointer arithmetic.
Note: You do not have access to the code of `struct cool_struct` and so it cannot be changed.

Solution:

```
1 void *ptr = (void *)p;  
2 ptr += 16;  
3 int *ip = (int*)ptr;
```

Question 6. (5 points) Consider the following snippet of code:

```
1 int add(int x, int y) { return x + y; }
2
3 int sub(int x, int y) { return x - y; }
4
5 int main(int argc, char **argv) {
6     int a = read_int_from_user(); // assume this is implemented elsewhere
7     int b = read_int_from_user();
8     char op = read_op_from_user();
9
10    int (*op_fn)(int, int) = (op == '+') ? sub : add;
11    printf("%d %c %d = %d\n", a, op, b, op_fn(a,b));
12
13    return 0;
14 }
```

What would be the output on the screen if the user inputs 1, 3, and '-' when prompted by this program?

Solution: It will print out $1 - 3 = 4$ because the function pointer is incorrectly assigned.