SER 334 **Practice** Exam 1

Updated 12/10/2021

Last Name: _____
First Name: _____
Last 4 digits of ASU ID: _____

Exam Instructions

The exam is open one note card (3x5 inches). No electronic items are allowed. Write legibly. Please use a pen (instead of a pencil) if you have one. There are 80 points available and the exam must be completed in 37.5 minutes. This exam has two types of questions:

Multiple choice questions: There are 30 points of multiple choice questions. An answer is selecting one option among the choices given. Each multiple choice is worth 2 to 5 points.

Short answer questions: There are 30 points of short answer questions. A typical answer is two or three sentences. Each short answer question is worth ~10 points.

Scenario questions: The programming questions are given near the end of the paper. They must be answered on the question paper. There are 20 points of write-in programming questions.

Topic	**Earned**	**Possible**
MC: C Programming I		10
SA: C Programming I		10
MC: C Programming II		10
MC: C Programming III		5
SA: C Programming III		10
MC: Operating-System Structures		5
SA: Operating-System Structures		10
Scen: C Programming II		20
Total:		80

Multiple Choice: C Programming

1. What is the difference between global variables and static variables? [5 points]

   (a) Global variables can be changed, while static variables cannot be changed.

   (b) There is no difference between global and static variables since they are both stored at the bottom of the execution stack.

   (c) Global variables can be accessed from anywhere, while static variables are only accessible within the scope where they are defined.

   (d) Global variables can only be accessed from the scope in which they were defined, while static variables are accessible from anywhere.

2. Consider the following function:

```
int* getNextUserID() {
    int users = db_get_user_count("db1");
    static int uid = users + 1;
    return &uid;
}
```

   Will the memory allocation in this function work reliably? [5 points]

   (a) Yes - it will return an address.

   (b) Yes - the memory used by the return value will persist since it is not stack memory.

   (c) No - the memory used will be overridden by any new function call the program makes.

   (d) No - it will only work some of the time, depending on when getNextUserID is called.

Short Answer: C Programming

3. For the following C code, fill in the value of each variable at the given point in the code. If the value of the variable cannot be determined at a given point in the code, write unknown. If the value is an address, write address of _____. [10 points]

```
int w = 0, *x = &w, y = 0;
// Point 1
w = 5;
y = -1;
// Point 2
x = &y;
y = 10;
w = y + *x;
// Point 3
```

Type	int	int pointer (dereferenced)	int pointer	int
Variable Name	w	*x	x	y
Point 1				
Point 2				
Point 3				

Multiple Choice: C Programming II

4. What is the output of the following snippet of code? [5 points]

```
void update(int *var) {
    int new_int = 10;
    var = &new_int;
}

void main() {
    int num = 20;
    int *pointer = &num;
    update(pointer);
    printf("%d",*pointer);
}
```

(a) 10

(b) 20

(c) A compiler error

(d) A run-time error

5. Consider a malicious agent which has gained access to the memory space of your running program. Are they more likely to access data that use stack or heap allocation? Explain. [5 points]

(a) Heap - they will go after the largest data structures in the program.

(b) Heap - it is more monolithic and easy to access.

(c) Stack - it is easier to access and take apart.

(d) Stack - it will grant access to static variables as well

Multiple Choice: C Programming III

6. Consider the following snippet of code from *Student.c,* which defines the class "Student."

```
typedef struct student student;
struct student {
    char* name;
    char* major;
    int gpa;
}
void destroy_student(student** s){
    free((*s)->name);
    free((*s)->major);
    free(*s);
    *s = NULL;
}
```

Why is the parameter for *destroy_student* a double pointer? [5 points]

(a) There is no reason the parameter is a double pointer, it would work the same as a single pointer.

(b) The parameter is a double pointer because it is a struct that points to other pointers.

(c) The parameter is a double pointer so that all variables of the struct can be freed appropriately.

(d) The parameter is a double pointer to avoid leaving a dangling pointer in the caller's scope.

Short Answer: C Programming III

7. Consider the following snippet of code that attempts to use a macro to compute slope: [10 points]

```
#define SLOPE(delta_y, delta_x) delta_y/delta_x

void main(){
    double x1 = 3;
    double x2 = -1;

    double y1 = 2;
    double y2 = 3;

    double slope = SLOPE(y1 - y2, x1 - x2);
    printf("%fl", slope);
}
```

   (a) This code will not calculate the slope correctly. What will the output be? Why?

   (b) How could you fix the problem by changing only the macro? How could you fix the problem without changing the macro?

Multiple Choice: Operating-System Structures

8. A mere month before the end of the semester, you have been assigned the task of designing and implementing an entire kernel from scratch. What is the best OS structure to implement in this situation and why? [5 points]

   (a) Simple since it allows for a short development time meaning it can be completed by the end of the semester.

   (b) Layered since it allows for a reliable design that is easy to maintain.

   (c) Microkernel since it is small and very efficient.

   (d) Modular since it allows for an extensible design in case you want to add to it.

Short Answer: Operating-System Structures

9. Consider the following pieces of functionality:

   (a) calculating the mean and standard deviation of a dataset.

   (b) finding the longest running program.

   (c) reading the current date/time from the system clock.

   Which of these would need to be implemented as an system call? Justify. [10 points]

Scenario: C Programming II [20 points]

10. The following declaration of a struct is used to represent a node in a linked list of grades.

```
struct grade_node {
    int value;
    char assignment[255];
    struct grade_node* next;
};
```

Complete the insert_grades(struct node* head) function. This function needs to read the data from the keyboard and store the values in a new node struct. Then, it adds the new node to the beginning of the linked list. [20 points]

```
void insert_grades(struct node** head) {
```

Extra Questions

The following questions were used on previous practice exams - they are not part of the practice exam, and may use content not covered in the current semester, but are provided for additional practice.

Short Answer: C Programming II

1. Define a new datatype to represent a book. A book should contain a title, an author, a genre (fiction, comedy, nonfiction, or drama; don't use a string), and bookmark position. Use all proper syntax and indicate any assumptions you made. [10 points]