

Homework 9

● Graded

Student

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Total Points

100 / 100 pts

Question 1

Overview

4 / 4 pts

✓ + 4 pts Correct

+ 4 pts Incorrect

Question 2

Initialization vs. Declaration

6 / 6 pts

2.1 (no title)

3 / 3 pts

✓ + 3 pts Correct (both)

+ 0 pts Incorrect

2.2 (no title)

3 / 3 pts

+ 0 pts Incorrect

✓ + 3 pts Correct (Declaration)

Question 3

Macros

6 / 6 pts

3.1 (no title)

6 / 6 pts

✓ + 6 pts Correct (6)

+ 0 pts Incorrect

Question 4

C Expressions

21 / 21 pts

4.1 (no title)

8 / 8 pts

✓ + 8 pts Correct:
x = 5
y = 4
z = 8

+ 2.5 pts Correct: x = 5

+ 2.5 pts Correct: y = 4

+ 3 pts Correct: z = 8

+ 0 pts Incorrect

4.2 (no title)

6 / 6 pts

✓ + 6 pts Correct (1)

+ 0 pts Incorrect

4.3 (no title)

7 / 7 pts

✓ + 7 pts Correct (18)

+ 0 pts Incorrect

Question 5

Memory Layout in C

15 / 15 pts

5.1 (no title) 3 / 3 pts

✓ + 3 pts Correct (Data Segment)

+ 0 pts Incorrect

5.2 (no title) 3 / 3 pts

✓ + 3 pts Correct (Data Segment or Stack)

+ 0 pts Incorrect

5.3 (no title) 3 / 3 pts

✓ + 3 pts Correct (stack)

+ 0 pts Incorrect

5.4 (no title) 3 / 3 pts

✓ + 3 pts Correct (stack)

+ 0 pts Incorrect

5.5 (no title) 3 / 3 pts

+ 0 pts Incorrect

✓ + 3 pts Correct (stack)

Question 6

Pointer Arithmetic

23 / 23 pts

6.1 (no title) 5 / 5 pts

✓ + 5 pts Correct (0x401E)

+ 0 pts Incorrect

6.2 (no title) 5 / 5 pts

✓ + 5 pts Correct (0x6E)

+ 0 pts Incorrect

6.3 (no title) 5 / 5 pts

✓ + 5 pts Correct (0x61)

+ 0 pts Incorrect

6.4 (no title) 5 / 5 pts

✓ + 5 pts Correct (0x66)

+ 0 pts Incorrect

6.5 (no title) 3 / 3 pts

✓ + 3 pts Correct:
(int *) ptr1 + 1
(short *) ptr1 + 2
&ptr1[4]

+ 2 pts Partially Correct:
(1) two correct
(2) three correct, one incorrect

+ 1 pt Partially Correct:
(1) one correct
(2) two correct, one incorrect
(3) three correct, two incorrect

+ 0 pts Incorrect

Question 7

Pointer Tracing

25 / 25 pts

7.1 (no title) 5 / 5 pts

✓ + 5 pts Correct (10)

+ 0 pts Incorrect

7.2 (no title) 5 / 5 pts

✓ + 5 pts Correct (the address of a)

+ 0 pts Incorrect

7.3 (no title) 5 / 5 pts

✓ + 5 pts Correct (12)

+ 0 pts Incorrect

7.4 (no title) 5 / 5 pts

✓ + 5 pts Correct (6)

+ 0 pts Incorrect

7.5 (no title) 5 / 5 pts

✓ + 5 pts Correct - does ONE of the following:
(1) mentions a segmentation fault or null-pointer exception
(2) explains error is occurring because trying to access memory location 0/dereference a null pointer
(3) explains that dereferencing a null pointer is undefined behavior

+ 2.5 pts Partially correct - mentions there is an error, but not specifically WHICH error or WHY it occurs

+ 0 pts Incorrect

Q1 Overview

4 Points

This homework is worth a total of 100 points.

This question (Q1) cannot be answered. It's used for formatting instructions. Do not worry about Gradescope saying you haven't answered one question. It's this one!

Please complete the following problems. The collaboration policy for the course still applies. Refer to the syllabus for details regarding this policy.

Q2 Initialization vs. Declaration

6 Points

Determine whether the following statements are declarations, initializations, or both.

Q2.1

3 Points

`int a = 2;`

- ☐ Declaration
- ☐ Initialization
- ☒ Both declaration and initialization

Q2.2

3 Points

`float b;`

- ☒ Declaration
- ☐ Initialization
- ☐ Both declaration and initialization

Q3 Macros

6 Points

Consider the following C code:

```
#include <stdio.h>
#define SUBTRACT(a, b) (a-b);

int main(void) {
    int x = SUBTRACT(5, 3 + 4);
    printf("%d", x);
}
```

Q3.1

6 Points

In the main function, SUBTRACT(5, 3 + 4) and the result is printed. What will be printed to the console?

Q4 C Expressions

21 Points

Assume the provided code compiles and executes as expected.

Q4.1

8 Points

```
int x = 4;  
int y = (++x) - 2;  
int z = x + (y++);
```

What is the value of **x** after the provided code is run?

5

What is the value of **y** after the provided code is run?

4

What is the value of **z** after the provided code is run?

8

Q4.2

6 Points

```
int a = 1;  
int b = 0;  
int c = (a&&b) || (b) ? (a&&b) : (a || b);
```

What is the value of **c** after the code is run?

1

Q4.3

7 Points

```
int a = 5;  
int b = 32;  
int c = (a<<1) + (b>>2);
```

What is the value of **c** in **decimal** after the code is run?

18

Q5 Memory Layout in C

15 Points

For question 5, refer to the following code.

```
#include <stdio.h>

int age = 10;
int x;

int growUp(int a) {
    int b = 0;
    b += a - x;
    return b;
}

int main() {
    int height = 10;
    int x = 1;
    for (int i = x; i < age; i++) {
        height += growUp(height);
    }
    return height;
}
```

Q5.1**3 Points**

Where in memory is the variable `age` stored?

- ☐ Text Segment
- ☒ Data Segment
- ☐ Heap
- ☐ Stack

Q5.2**3 Points**

Where in memory is the variable `x` stored?

- ☐ Text Segment
- ☒ Data Segment
- ☐ Heap
- ☐ Stack

Q5.3**3 Points**

Where in memory is the variable `b` stored?

- ☐ Text Segment
- ☐ Data Segment
- ☐ Heap
- ☒ Stack

Q5.4

3 Points

Where in memory is the variable `height` stored?

- ☐ Text Segment
- ☐ Data Segment
- ☐ Heap
- ☒ Stack

Q5.5

3 Points

Where in memory is the variable `i` stored?

- ☐ Text Segment
- ☐ Data Segment
- ☐ Heap
- ☒ Stack

Q6 Pointer Arithmetic

23 Points

The following tables are a representation of memory in a computer. Each memory address stores 1 byte (8 bits) of information.

Address	x4000	x4001	x4002	x4003	x4004	x4005	x4006	x4007	x4008	x4009	x400A	x400B	x400C	x400D	x400E	x400F
Value	79	6F	75	27	72	65	20	61	20	6E	65	72	64	20	69	66

Address	x4010	x4011	x4012	x4013	x4014	x4015	x4016	x4017	x4018	x4019	x401A	x401B	x401C	x401D	x401E	x401F
Value	20	79	6F	75	20	64	65	63	6F	64	65	20	74	68	69	73

The following variables are also declared:

```
char *ptr1 = (char *) 0x401E;  
char *ptr2 = (char *) 0x4009;  
char *ptr3 = (char *) (int *) 0x4005 + 2;  
char *ptr4 = (char *) ((short *) ptr2 + 3);
```

For this problem, assume `sizeof(int) == 4` and `sizeof(short) == 2`.

Q6.1

5 Points

What does `ptr1` equal? Format your answer in hexadecimal with the prefix `0x`.

0x401E

Q6.2

5 Points

What does `*ptr2` evaluate to? Format your answer in hexadecimal with the prefix `0x`.

0x6E

Q6.3**5 Points**

What does `*ptr3` evaluate to? Format your answer in hexadecimal with the prefix `0x`.

0x61

Q6.4**5 Points**

What does `*ptr4` evaluate to? Format your answer in hexadecimal with the prefix `0x`.

0x66

Q6.5**3 Points**

Select all of the following expressions which evaluate to the same value as `ptr1 + 4`.

☐`(int *) ptr1 + 4`☒`(int *) ptr1 + 1`☒`(short *) ptr1 + 2`☒`&ptr1[4]`☐`ptr1[4]`

Q7 Pointer Tracing

25 Points

Consider the following code snippet:

```
int a = 10;  
int b = 6;  
int *pa = &a;  
int *pb = &b;  
int **ppa = &pa;  
int **ppb = &pb;
```

For each part, give the updated value of the variable. Updates in each question are independent, so **DO NOT** carry updates across questions.

Q7.1

5 Points

What is the value of `**ppa`?

☐ 6

☒ 10

☐ pa

☐ pb

Q7.2

5 Points

Given that `ppa` and `pb` are reassigned as follows:

```
ppa = &pb;  
pb = &a;
```

What is the value of `*ppa`?

- ☐ the address of `pb`
- ☒ the address of `a`
- ☐ the address of `pa`
- ☐ the address of `b`

Q7.3

5 Points

Given the new assignment `*pb = 12`, what is the value of `b`?

- ☐ 6
- ☒ 12
- ☐ 10
- ☐ the address of `pb`

Q7.4

5 Points

Given that `*ppb` and `*pa` are reassigned as follows:

```
*ppb = pa;  
++*pa;
```

What is the value of `b`?

- ☒ 6
- ☐ 10
- ☐ 11
- ☐ 7

Q7.5

5 Points

Given the new assignment `pb = 0`, what happens if we try to run the following code? Explain your answer.

```
printf("%d\n", **ppb);
```

Running the following code will result in a Segmentation fault. This is because the program accessed a memory that was not assigned. Assigning `pb` to 0 means it is a null pointer. Double dereferencing the pointer will mean trying to access address 0 which is in the system space. The program will not be able to access this location, resulting in a segmentation fault or undefined behaviour.