Quiz 10 (Midterm 2 Review)

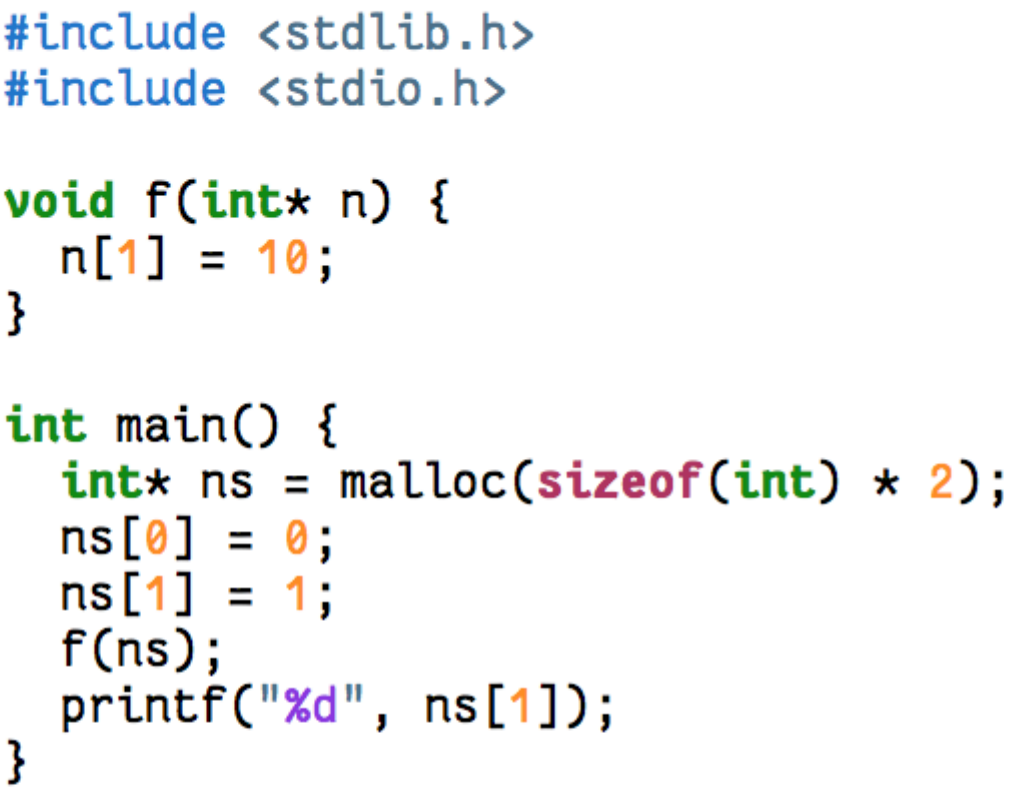
For all of these questions (and on the upcoming midterm), assume ints and addresses take 4 bytes each, and chars take 1 byte. In general, assume that things are compiled and run on the 32-bit ARM environment on the pi cluster for these questions and exams.

* Required

1. **Email address** *

   ANSWER KEY

2. **What does this program print?** *



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

void f(int* n) {
  n[1] = 10;
}

int main() {
  int* ns = malloc(sizeof(int) * 2);
  ns[0] = 0;
  ns[1] = 1;
  f(ns);
  printf("%d", ns[1]);
}
```

Mark only one oval.

○ 0

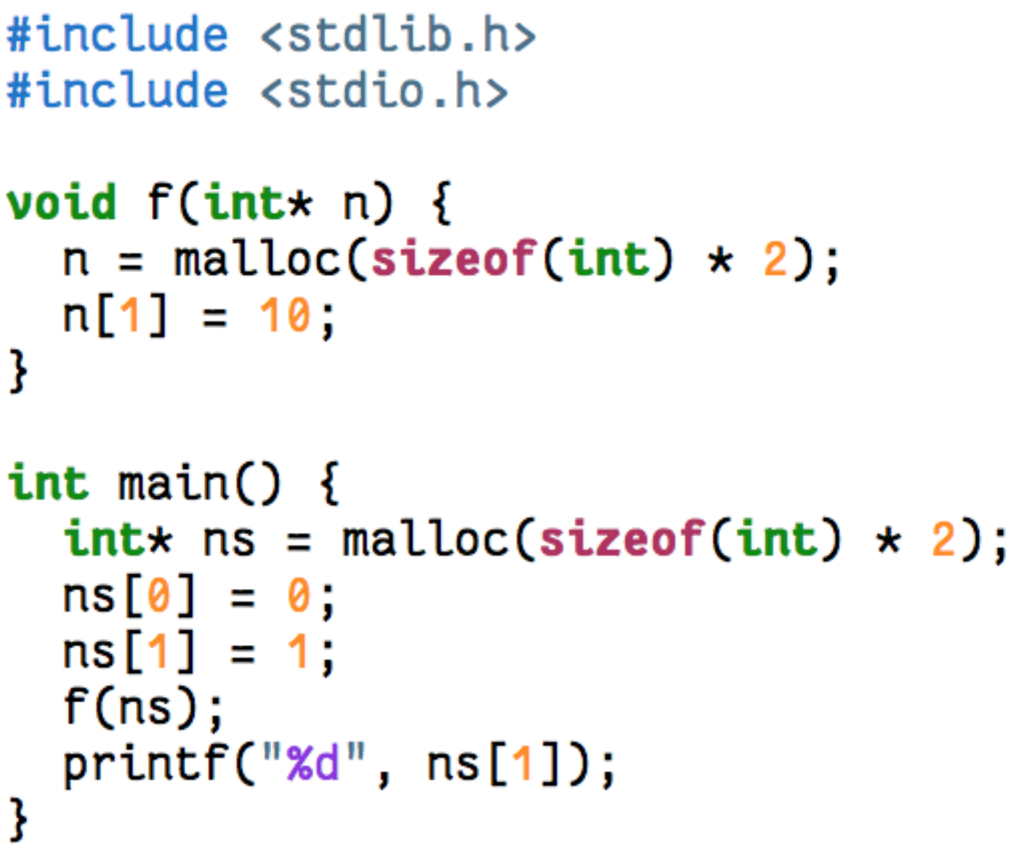
○ 1

○ 2

○ 8

○ [✓ 10]

3. **What will this program print?** *



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

void f(int* n) {
  n = malloc(sizeof(int) * 2);
  n[1] = 10;
}

int main() {
  int* ns = malloc(sizeof(int) * 2);
  ns[0] = 0;
  ns[1] = 1;
  f(ns);
  printf("%d", ns[1]);
}
```

Mark only one oval.

○ 0

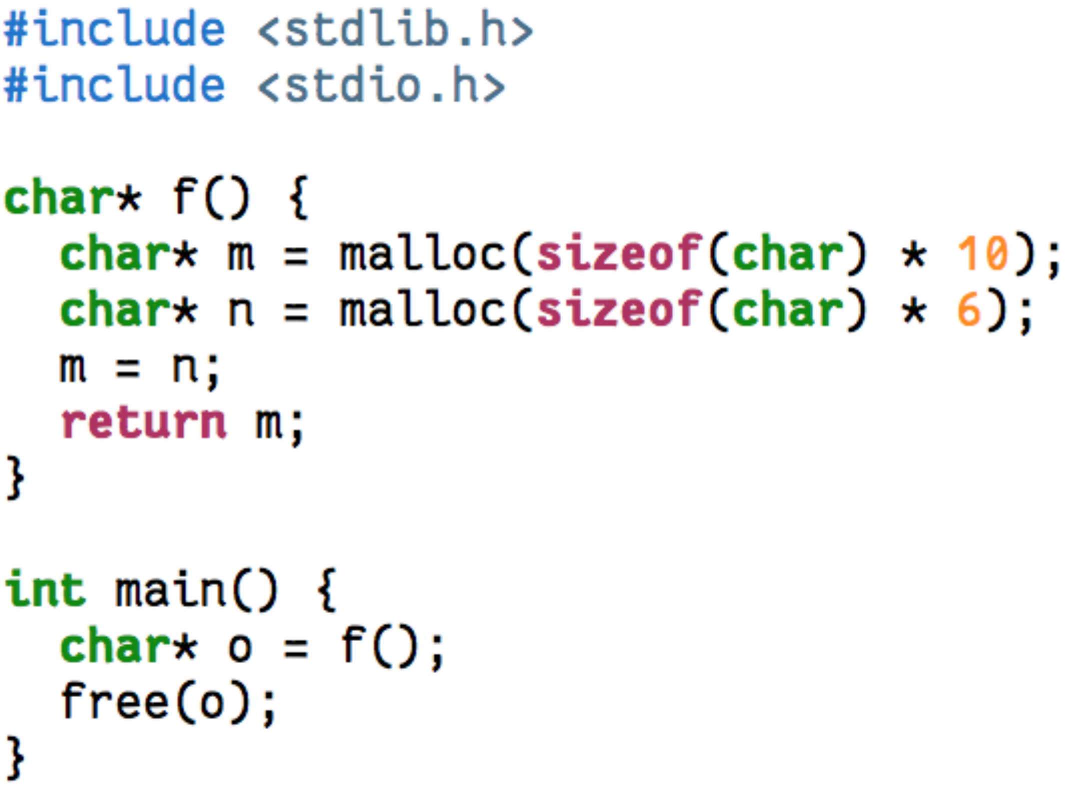
○ [✓ 1]

○ 2

○ 8

○ 10

4. **How many bytes does the call to free relinquish back to the memory management system?** *



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

char* f() {
  char* m = malloc(sizeof(char) * 10);
  char* n = malloc(sizeof(char) * 6);
  m = n;
  return m;
}

int main() {
  char* o = f();
  free(o);
}
```

Mark only one oval.

○ 16

○ 10

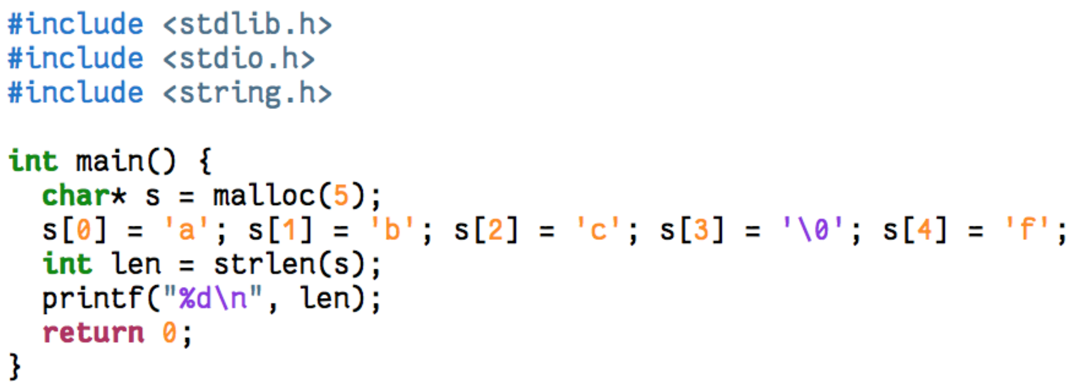
○ [✓ 6]

○ 0

○ 40

○ 24

5. **What will this program print?** *



```
#include <stdlib.h>
#include <stdio.h>
#include <string.h>

int main() {
  char* s = malloc(5);
  s[0] = 'a'; s[1] = 'b'; s[2] = 'c'; s[3] = '\0'; s[4] = 'f';
  int len = strlen(s);
  printf("%d\n", len);
  return 0;
}
```

Mark only one oval.

○ abc

○ 5

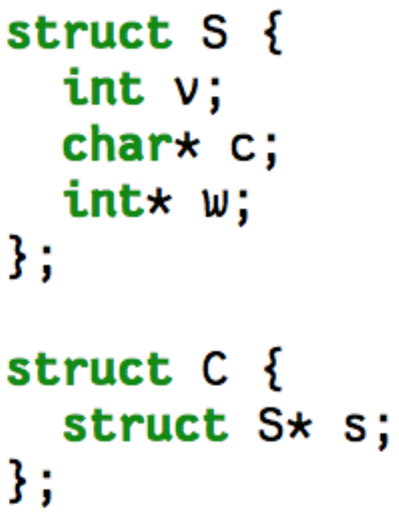
○ 4

○ abcf

○ 3

○ 2

6. **How many bytes are needed to store the contents of the struct C?** *



```
struct S {
   int v;
   char* c;
   int* w;
};

struct C {
   struct S* s;
};
```

4

7. **Based on the calling convention discussed in class and the book, the statement "push {lr}" at the beginning of a function makes sense to pair with which of the following at the end of a function?** *

Mark only one oval.

○ pop {lr}

○ mov pc, lr

○ [✓ pop {pc}]

○ mov lr, pc

8. **The push instruction changes the value of sp** *

Mark only one oval.

○ [✓ True]

○ False

9. **The str instruction changes the value of sp** *

Mark only one oval.

○ True

○ [✓ False]

10. **The bl instruction changes the value of sp**

Mark only one oval.

○ True

○ [✓ False]

11. **In the compiled output of the C expression "x->a = v", the part of the output that does the real work of assigning into the "a" field of the struct will be...** *

Mark only one oval.

○ A ldr instruction

○ [✓ A str instruction]

○ A mov instruction

○ A push instruction

○ A pop instruction

12. **Which of these is a good rule for thinking about malloc, free, and avoiding memory leaks?** *

Mark only one oval.

○ There should always be an equal number of times the word "malloc" and "free" appear in the code

○ Every function that uses a pointer should free it before the end of the function

○ [✓ For each time malloc is called in the running program, there should at some point later be a corresponding call to free for that address]

○ For each time malloc is called in the running program, there should at some point later be at least one, and maybe more than one, call to free for that address

13. **Temporary values that a function uses, and "remembers" while calling other functions, can be stored in (choose ALL that apply)** *

Check all that apply.

- □ r0
- □ r1
- ☑ r4
- ☑ r5
- ☑ memory addresses that it makes space for by changing the value of sp

14. **Which of the following things is a function responsible for doing before returning? Choose ALL that apply** *

Check all that apply.

- ☑ Restoring the values of r4-r10 that were present before the function began running
- □ Restoring the values of r0-r3 that were present before the function began running
- □ Restoring the value of lr that was present before the function began running
- ☑ Restoring the value of sp that was present before the function began running
- ☑ Putting the return value in r0

15. **Which of the following actions most directly corresponds to the act of returning from a function?** *

Mark only one oval.

- ○ Changing the value of lr
- ○ [✓ Changing the value of pc]
- ○ Pushing values onto the stack
- ○ Allocating memory on the heap

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