

CS241 SP15 Exam 1: Solution Key

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A VERSION OF THESE QUESTIONS MAY APPEAR IN A FUTURE QUIZ

1. (1 point.) Which of the following best describes the C code below? Assume this is part of a C main method and malloc returns a non-NULL value.

```
1  int* ptr = (int*) malloc(sizeof(int));
2  *ptr = 42;
3  free(ptr);
4  ptr = (int*) 42;
5  free(ptr);
```

- (A) C uses 'new' and 'delete' not 'malloc' and 'free'
- (B) Will always crash at line 3
- (C) May crash at line 2 if an integer requires more than 4 bytes of storage
- (D) Allocates 4 bytes of memory on the stack
- (E) Will always crash at line 5

Correct answer: E.

Your answer: E.

1 out of 1 point received

2. (1 point.) The `printf` function declaration can be included in your C program by writing...

- (A) `#include <stdio.h>`
- (B) None of the other responses are correct
- (C) `#define "sys/printf.h"`
- (D) `#define iostream.h(printf)`
- (E) `#include <iostream>`

Correct answer: A.

Your answer: A.

1 out of 1 point received

3. (1 point.) The following C code is executed as part of a main method. Which line, if any, will likely cause the program to crash?

```
1 char * ptr = (char*) rand(); /* rand() returns an random integer value */
2 int * b = (int*) ptr;
3 b = b + 1;
4 ptr = (char*) rand();
5 *ptr = (char) rand();
```

(A) 3

(B) 2

(C) 4

(D) None of the other responses are correct

(E) 5

Correct answer: E.

Your answer: E.

1 out of 1 point received

4. (1 point.) Carefully read the following C code and determine how often it will print lucky.

```
int a = rand(); /* returns a random int */  
if( a = 0) printf("You're lucky!");
```

- (A) You have a small chance of being lucky
- (B) You are always lucky
- (C) You are never lucky

Correct answer: C.

Your answer: C.

1 out of 1 point received

5. (1 point.) Which one of the following best describes how to find the length of a C string?
- (A) Requires $O(N)$ search to find the terminating null character `\0`
 - (B) Requires $O(N)$ reverse linear search
 - (C) Requires $O(1)$ lookup to read the length byte
 - (D) Is compiler dependent and not part of the C specification
 - (E) None of the other responses are correct

Correct answer: A.

Your answer: A.

1 out of 1 point received

6. (1 point.) Which of the following best describes the design goal(s) of an operating system?
- (A) An operating system must efficiently manage scarce resources (CPU cores, RAM,...)
 - (B) An operating system provides a set of services to user programs that can be accessed by system calls
 - (C) An operating system provides security and guards against malfunctioning user programs
 - (D) All of the other responses are correct
 - (E) An operating system provides a level of abstraction above low-level hardware interfaces

Correct answer: D.

Your answer: D.

1 out of 1 point received

7. (1 point.) Which response best describes the following student code that attempts to implement string copy?

```
1 void mystery(char*dest, char*src) {  
2   if( src == NULL || dest==NULL) return;  
3   while(*src) {  
4     dest = src;  
5     src ++; dest++;  
6   }  
7   *dest = (char)0;  
8 }
```

- (A) The function will be correct by changing a small error at line 5
- (B) The function will be correct by changing two small errors at line 4 and 5
- (C) The function will be correct by changing a small error at line 7
- (D) The function will be correct by changing a small error at line 4
- (E) The function will be correct by changing a small error at line 3

Correct answer: D.

Your answer: D.

1 out of 1 point received

8. (1 point.) Which one of the following does not depend on the computer architecture?

- (A) sizeof(int)
- (B) sizeof(char)
- (C) sizeof(int*)
- (D) sizeof(void*)
- (E) sizeof(char*)

Correct answer: B.

Your answer: B.

1 out of 1 point received

9. (1 point.) Which of the following best describes the C code below? Assume this is part of a C main method and malloc returns a non-NULL value.

```
1 void* v = malloc(4);  
2 free(v);  
3 free(v);
```

- (A) To be error free line 1 requires a cast to an int or character pointer
- (B) Allocates 4 bytes of memory on the stack
- (C) Is a memory allocation error described as “free after malloc”
- (D) Is a memory allocation error described as “double free”
- (E) Is valid and error-free

Correct answer: D.

Your answer: D.

1 out of 1 point received

10. (1 point.) Which one of the following is NOT correct?
- (A) `man` pages describe system calls (section 2) and library calls (section 3) and include return values and required header files.
 - (B) `man fork` is example of using the 'man' utility to read the manual page on `fork` system call
 - (C) Temporary, non-static variables declared inside a function are called 'automatic variables' and are allocated on the stack
 - (D) `man atoi` is example of using the 'man' utility to read the manual page on `atoi` C library call
 - (E) Variables with the static modifier are allocated using stack memory

Correct answer: E.

Your answer: E.

1 out of 1 point received

11. (1 point.) The following expression uses `sizeof` and `strlen` function. What is the value of result?

```
int result = 1 + sizeof("abc") + ( sizeof("abc") * strlen("abc") );
```

- (A) None of the other responses are correct
- (B) 17
- (C) 16
- (D) 13
- (E) 21

Correct answer: B.

Your answer: B.

1 out of 1 point received

12. (1 point.) Which one of the following correctly allocates enough bytes on the heap to copy an existing string pointed to by a character pointer, `char* src`?

- (A) `malloc(strlen(src) + 1);`
- (B) `char array[strlen(src)];`
- (C) `new string(sizeof(src) + 1);`
- (D) None of the other responses are correct
- (E) `malloc(sizeof(src) + 1);`

Correct answer: A.

Your answer: A.

1 out of 1 point received

13. (1 point.) Which one of the following best describes the **free** call in the following code example?

```
1 int* v = NULL;  
2 free(v);
```

- (A) Is invalid and commonly described as a ‘free-on-null’ error
- (B) Is invalid and commonly described as a ‘NULL-free’ error
- (C) Frees up all previously allocated memory
- (D) The above **free** call has no effect and is error free

Correct answer: D.

Your answer: D.

1 out of 1 point received

14. (1 point.) Which one of the following is correct?

- (A) `printf` always calls `write` when it is called with more than one argument
- (B) `printf` is a system call, `write` is a C library call
- (C) `printf` uses a buffer so may not call `write` every time it is called
- (D) `write` and `printf` are identical and have the same function prototype
- (E) `write` always calls `printf` when it is called

Correct answer: C.

Your answer: C.

1 out of 1 point received

15. (1 point.) Which response best describes the following code? Assume `ptr` holds the address `0x8400`.

```
1 void* ptr = /* code not shown */  
2 char* ptr2 = (char*)ptr;  
3 void* x = & ptr2 + 1;  
4 int result = *(ptr2 +1);
```

- (A) One byte of memory at address `0x8400` is read at line 2
- (B) None of the other responses are correct
- (C) One byte of memory at address `0x8401` is read at line 4
- (D) Line 4 has a syntax error
- (E) One byte of memory at address `0x8401` is read at line 3

Correct answer: C.

Your answer: C.

1 out of 1 point received

16. (1 point.) Which one of the following is true for typical layout of a process's memory?
- (A) Program code is not stored in the process's memory
 - (B) Program constants are read-only
 - (C) Writing to read-only memory is ignored by the operating system
 - (D) All of the process's memory address maps to physical RAM address
 - (E) Program constants are stored in the stack

Correct answer: B.

Your answer: B.

1 out of 1 point received

17. (1 point.) Which one of the following best describes `malloc`?
- (A) `malloc` will throw an exception if there is insufficient free ram
 - (B) `malloc` will always successfully allocate heap memory
 - (C) `malloc` will return `NULL` if it cannot reserve sufficient heap memory
 - (D) None of the other responses are correct
 - (E) `malloc` will return `-1` if it cannot reserve sufficient stack memory

Correct answer: C.

Your answer: A.

0 out of 1 point received

18. (1 point.) Which response best describes the behavior of the following code?

```
int mystery(char*start) {  
    if( start == NULL) return NULL;  
    char* p= start;  
    while(*p !='q') p++;  
    return p - start;  
}
```

- (A) `mystery("ABC")` is undefined (and may crash)
- (B) `mystery(NULL)` is undefined (and may crash)
- (C) `mystery(NULL)` returns 1
- (D) `mystery("q")` returns 1
- (E) `mystery("q")` returns 2

Correct answer: A.

Your answer: A.

1 out of 1 point received

19. (1 point.) In the Linux operating system, which is based on the POSIX standard, which one of the following is true?

- (A) A program can only be run by a single user at a time
- (B) Processes can write directly into another processes memory to easily crash the other process
- (C) Shell utilities (e.g. `cat` `ls` `make`) are written in assembler
- (D) Each process is isolated and runs in its own virtual memory space
- (E) The overhead of a system call is the same as a C library call

Correct answer: D.

Your answer: D.

1 out of 1 point received

20. (1 point.) If `sizeof(int)` is 2 what will be the expected output of the following C code?

```
char* ptr = "ABCDEF";  
int * x = (int*) ptr;  
printf("%s", x + 1 );
```

- (A) CDEF
- (B) ABCDEF1
- (C) BCDEF
- (D) Segmentation Fault
- (E) EF

Correct answer: A.

Your answer: A.

1 out of 1 point received

21. (1 point.) Which one of the following is NOT correct?

- (A) `cat abc` will print the contents of the file `abc` to the terminal
- (B) Writing a null character into the middle of a C string will have no effect when the string is printed
- (C) `./bitcoin > coins` runs a program named `bitcoin` but redirects standard output to a file named `coins`
- (D) A C string is just an array of `chars` which is terminated with a null character
- (E) A single variable of C type `char` is not sufficient to store an international unicode (16 bit) character

Correct answer: B.

Your answer: B.

1 out of 1 point received

22. (1 point.) Which one of the following best describes the following C code?

```
1 char array[] = "ABC";  
2 char x = array[3];  
3 char y = array[4];  
4 x = y;
```

- (A) x may contain data from another variable
- (B) y may contain data from another variable
- (C) The program will crash at line 2
- (D) The program will throw an exception
- (E) The program will not compile

Correct answer: B.

Your answer: B.

1 out of 1 point received

23. (1 point.) My C program prints Hello 42 0x38a. Which response is the best choice for the next line?

```
1 char* ptr = "Hello";
2 int x = 84 >>1;
3 ?
```

- (A) `printf("$1s $2d $1p",ptr,x);`
- (B) `printf("${ptr} ${x} 0x38a");`
- (C) `write(ptr,5);write(x,2); write(*ptr,5);`
- (D) `printf("%s %d %p",ptr,x,ptr);`
- (E) `cout <<ptr<<" "<<x<<" 0x38a";`

Correct answer: D.

Your answer: D.

1 out of 1 point received

Summary of answers:

Question	Correct Answer	Your Answer	Points
1	E	E	1
2	A	A	1
3	E	E	1
4	C	C	1
5	A	A	1
6	D	D	1
7	D	D	1
8	B	B	1
9	D	D	1
10	E	E	1
11	B	B	1
12	A	A	1
13	D	D	1
14	C	C	1
15	C	C	1
16	B	B	1
17	C	A	0
18	A	A	1
19	D	D	1
20	A	A	1
21	B	B	1
22	B	B	1
23	D	D	1
Total			22