CS241 SP15 Exam 1: Solution Key

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A VERSION OF THESE QUESTIONS MAY APPEAR IN A FUTURE QUIZ

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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

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>`

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

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

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

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

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

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*)

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

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

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

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);`

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

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

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

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

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

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

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

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`

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 `char`s 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

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

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";`

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