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.) 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) `write(ptr,5);write(x,2); write(*ptr,5);`

(C) `printf("${ptr} ${x} 0x38a");`

(D) `cout <<ptr<<" "<<x<<" 0x38a";`

(E) `printf("%s %d %p",ptr,x,ptr);`

2. (1 point.) Which one of the following best describes how to find the length of a C string?

(A) Requires O(1) lookup to read the length byte

(B) None of the other responses are correct

(C) Requires O(N) reverse linear search

(D) Is compiler dependent and not part of the C specification

(E) Requires O(N) search to find the terminating null character `\0`

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) 4

(B) 5

(C) None of the other responses are correct

(D) 2

(E) 3

4. (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("q")` returns 2

(C) `mystery(NULL)` is undefined (and may crash)

(D) `mystery("q")` returns 1

(E) `mystery(NULL)` returns 1

5. (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) 13

(B) None of the other responses are correct

(C) 16

(D) 21

(E) 17

6. (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) Each process is isolated and runs in its own virtual memory space

(D) The overhead of a system call is the same as a C library call

(E) Shell utilities (e.g. `cat ls make`) are written in assembler

7. (1 point.) Which one of the following is NOT correct?

(A) Variables with the static modifier are allocated using stack memory

(B) man pages describe system calls (section 2) and library calls (section 3) and include return values and required header files.

(C) `man fork` is example of using the 'man' utility to read the manual page on `fork` system call

(D) Temporary, non-static variables declared inside a function are called 'automatic variables' and are allocated on the stack

(E) `man atoi` is example of using the 'man' utility to read the manual page on `atoi` C library call

8. (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) Allocates 4 bytes of memory on the stack

(B) Is a memory allocation error described as "double free"

(C) Is a memory allocation error described as "free after malloc"

(D) To be error free line 1 requires a cast to an int or character pointer

(E) Is valid and error-free

9. (1 point.) The `printf` function declaration can be included in your C program by writing...

(A) None of the other responses are correct

(B) `#include <iostream>`

(C) `#define "sys/printf.h"`

(D) `#include <stdio.h>`

(E) `#define iostream.h(printf)`

10. (1 point.) Which one of the following best describes for the following C code?

```
1 char array[] = "ABCD";
2 char x = array[5];
3 char y = array[0];
4 x = y;
```

(A) `y` may contain data from another variable

(B) None of the other responses are correct

(C) The program will not compile

(D) The program will crash at line 4

(E) `x` may contain data from another variable

11. (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 5

(C) Will always crash at line 3

(D) Allocates 4 bytes of memory on the stack

(E) May crash at line 2 if an integer requires more than 4 bytes of storage

12. (1 point.) Which one of the following is IMPOSSIBLE?

(A) sizeof(char) is 2

(B) sizeof(int) is 8

(C) sizeof(char*) is 8

(D) sizeof(void*) is 4

(E) sizeof(int*) is 4

13. (1 point.) Which one of the following is true for typical layout of a process's memory?

(A) Program constants are stored in the stack

(B) Program code is not stored in the process's memory

(C) All of the process's memory address maps to physical RAM address

(D) Writing to read-only memory is ignored by the operating system

(E) Program constants are read-only

14. (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  *src = (char)0;
8 }
```

(A) The function will be correct by changing a small error at line 4

(B) The function will be correct by changing a small error at line 3

(C) The function will be correct by changing two small errors at line 4 and 5

(D) The function will be correct by changing a small error at line 5

(E) The function will be correct by changing a small error at line 7

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 0x8401 is read at line 4

(B) One byte of memory at address 0x8401 is read at line 3

(C) None of the other responses are correct

(D) One byte of memory at address 0x8400 is read at line 2

(E) Line 4 has a syntax error

16. (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) `EF`

(B) `Segmentation Fault`

(C) `CDEF`

(D) `BCDEF`

(E) `ABCDEF1`

17. (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 = 4) printf("You're lucky!");
```

(A) You are always lucky

(B) You have a small chance of being lucky

(C) You are never lucky

18. (1 point.) Which one of the following is correct?

(A) `write` and `printf` are identical and have the same function prototype

(B) `write` always calls `printf` when it is called

(C) `printf` uses a buffer so may not call `write` every time it is called

(D) `printf` always calls `write` when it is called with more than one argument

(E) `printf` is a system call, `write` is a C library call

19. (1 point.) Which of the following best describes the design goal(s) of an operating system?

(A) An operating system provides a set of services to user programs that can be accessed by system calls

(B) All of the other responses are correct

(C) An operating system provides a level of abstraction above low-level hardware interfaces

(D) An operating system provides security and guards against malfunctioning user programs

(E) An operating system must efficiently manage scarce resources (CPU cores, RAM,...)

20. (1 point.) Which one of the following best describes `malloc`?

(A) `malloc` will return -1 if it cannot reserve sufficient stack memory

(B) `malloc` will throw an exception if there is insufficient free ram

(C) None of the other responses are correct

(D) `malloc` will always successfully allocate heap memory

(E) `malloc` will return `NULL` if it cannot reserve sufficient heap memory

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 correctly allocates enough bytes on the heap to copy an existing string pointed to by a character pointer, `char* src`?

(A) `char array[ strlen(src) ];`

(B) `new string( sizeof(src) + 1);`

(C) `malloc( strlen(src) + 1);`

(D) None of the other responses are correct

(E) `malloc( sizeof(src) + 1);`

23. (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) The above `free` call has no effect and is error free

(C) Frees up all previously allocated memory

(D) Is invalid and commonly described as a 'NULL-free' error

Summary of answers:

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