Lab 0 – Embedded Systems – Nicholas Holman, 100483825

Conceptual Questions

1) *What are some of the benefits of the C language? Name an example where C is used.*

-C is compiler based rather than interpreter based – this makes its compilation speed faster than other languages.
-C allows more control over resources, it is very closely linked with the local environment of connected hardware. It was designed to give access to any level of the computer down to raw machine language. This makes it very flexible.
-C's primary advantage is in its speed.
-C is particularly chosen to work on programs that work with the operating system. Examples: Language Compilers, Assemblers, Text Editors, Language Interpreters.

2) *What is a compiler and what does it do?*

A compiler is a program that processes statements written in programming languages in order to convert those statements into machine language that can be read by a computer's processor.

3) *What is a makefile and what does it do?*

A makefile is a special file that is used as a tool to easily execute multiple commands (that are contained in the makefile) and also to more-easily compile large programs that utilize many source or header files.

4) *Name 5 headers from the C library and explain their purpose.*

math.h – provides common mathematic functions
float.h – provides limits of float types
stdlib.h – provides general utilities such as memory management and random-number usage
time.h – provides time and date utilities
signal.h – provides signal handling

5) *Lookup one function from each of the header files and describe what it does:*

math.h – acos() – computes the arc-cosine of an argument
float.h – b – base of radix of the exponent representation, 2 for binary, 10 for decimal, etc
stdlib.h – double atof(const char *str) – Converts the string pointed to, to a floating point number
time.h – clock_t clock(void) – Returns the processor clock time
signal.h – int raise(int sig) – Causes signal 'sig' to be generated.

6) List each of the modes for the fopen function to perform the following operations: read,write,read and write, append to a file.

read – allows the file to be read line by line
write – writes a char variable into a file and overwrites whatever was there.

read and write – allows the file to be read and then written over
append – allows a char variable to be appended to the end of a file without overwriting any other data.

7) Does dynamic memory use stack or heap? What is the difference between them?

Stack is used for **static** memory allocation while Heap is used for **dynamic** memory allocation.

The stack allows very fast access and doesn't have to explicitly de-allocate variables. However it has a limit and is only for local-variables.

The heap allows variables to be accessed globally and has no limit on memory size, yet has relatively slower access.

8) Explain what a pointer is, and provide examples of how to change the address that a pointer points to and how to access the data that a pointer points to.

A pointer is a variable whose value is the address of another variable.

The data that a pointer points to can be changed by assigning the pointer variable to an already-declared variable using an ampersand(&), example:

```
int var = 20;
int *ip;
ip = &var;
```

That variable can then be accessed by using an asterisk and the pointer variables name. Example:

```
printf("Value of ip variable: %d", *ip);
```

9) Read the documentation on the malloc and free functions and explained briefly how to use malloc.

Malloc is used to allocate a block of memory onto the Heap, while free is used to deallocate that block of memory. It is used as follows:

```
char *str;

str = (char *) malloc(15);
```

10) What is the difference between malloc and calloc?

Malloc allocates a designated size of block-memory to the Heap while Calloc does the same but sets the allocated memory to zero.