COMP 122/L Final Practice Exam

The final exam will be comprehensive, but with a bias towards content covered since the last exam. With this in mind, you should be especially prepared for the following topics:

- The use of memory on MIPS (with the `lw` and `sw` instructions)
- Truth tables
- Circuits
- Boolean formulas
- De Morgan's laws
- Karnaugh maps (K-maps), including those with *don't cares*

In addition to this review, you should also review:

- All your labs
- All the handouts
- Prior exams and their practice exams

This review itself is not intended to be comprehensive, and only focuses on topics since the last exam.

1.) Consider the following `.data` section of a MIPS program:

```
.data
array:
  .word 7, 2, 4
```

Finish this MIPS program so that it prints out every element of this array, WITHOUT using a loop. As a hint, you'll need to use different offsets in your `lw` instructions. Don't forget to terminate the program.

2.) Consider the following `.data` section of a MIPS program:

```
.data
array:
  .word 7, 2, 4, 8
copy:
  .word 0, 0, 0, 0
```

Finish this MIPS program so that `copy` will contain a copy of the contents of `array`. You MUST use a loop. Don't forget to terminate the program.

3.) Consider the following C-like code:

```
int array[] = {4, 8, 9, 1, 0, 5};
for (int index = 0; index < 6; index += 2) {
  int temp = array[index];
  array[index] = array[index + 1];
  array[index + 1] = temp;
}
```

This code started to be translated to MIPS assembly as follows:

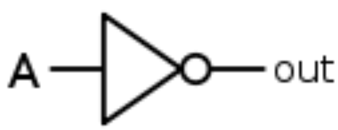
```
.data
array:
  .word 4, 8, 9, 1, 0, 5
```

Complete the translation of this code. Don't forget to terminate the program.

4.) What component is shown below?

5.) What component is shown below?

6.) What component is shown below?



7.) Draw the circuit corresponding to the following sum-of-products equation:

```
R = !A!B + AB
```

8.) Consider the following sum-of-products equation:

```
R = !ABC + ABC + A!B!C
```

8.a.) Write the equation as a truth table.

8.b.) Simplify it using a Karnaugh map.

9.) Consider the truth table below, which includes *don't cares*:

A	B	C	D	U
0	0	0	0	1
0	0	0	1	X
0	0	1	0	0
0	0	1	1	1
0	1	0	0	X
0	1	0	1	1
0	1	1	0	0
0	1	1	1	X
1	0	0	0	1
1	0	0	1	0
1	0	1	0	X
1	0	1	1	0
1	1	0	0	1
1	1	0	1	0
1	1	1	0	X
1	1	1	1	0

9.a.) Write out the unoptimized sum-of-products equation corresponding to this truth table. As a hint, *don't cares* can be skipped over.

9.b.) Using a K-map, derive an optimized equivalent sum-of-products equation that exploits *don't cares* where appropriate.

10.) Consider the truth table below, which includes *don't cares*:

A	B	C	D	Output
0	0	0	0	0
0	0	0	1	0
0	0	1	0	X
0	0	1	1	X
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	X
1	0	0	1	0
1	0	1	0	1
1	0	1	1	X
1	1	0	0	1
1	1	0	1	0
1	1	1	0	X
1	1	1	1	1

Using a K-map, derive an optimized equivalent sum-of-products equation that exploits *don't cares* where appropriate.