Tutorial 6
Karnaugh Maps

Exercise 1

Let us consider *N*, a number encoded in 3 bits (*C*, *B*, *A*). *A* is the least significant bit. Using Karnaugh maps, write down the most simplified expression of *S = f(N)* for each of the following:

- *S* = 1 when $N \geq 3$
- *S* = 1 when $2 < N \leq 6$
- *S* = 1 when *N* = 1, 3 or 5
- *S* = 1 when *N* = 1, 3 or 5 and S is undefined when *N* = 0 or 4

Exercise 2

We want to design a circuit that performs the two's complement operation. This circuit has three inputs (*C*, *B*, *A*) and three outputs (*C'*, *B'*, *A'*). *A* and *A'* are the least significant bits.

1. Write down the truth table for the three outputs.
2. Write down their most simplified expressions.

We want to design a circuit that converts a natural binary number into a Gray code number. This circuit has three inputs (*C*, *B*, *A*) and three outputs (*C'*, *B'*, *A'*). *A* and *A'* are the least significant bits.

3. Write down the truth table for the three outputs.
4. Write down their most simplified expressions.

Exercise 3

Let us consider *N*, a number encoded in 4 bits (*D*, *C*, *B*, *A*). *A* is the least significant bit. Using Karnaugh maps, write down the most simplified expression of *S = f(N)* for each of the following:

- *S* = 1 when $N \geq 10$
- *S* = 1 when *N* = 0, 4, 8, 10, 12 or 14
- *S* = 1 when *N* = 0, 2, 5, 7, 8, 10, 13 or 15
- *S* = 1 when *N* = 2, 10, 11 or 14
- *S* = 1 when *N* = 2, 10, 11 or 14 and *S* is undefined when *N* = 6, 9, 13 or 15