

## MATH230: Tutorial XY

### Subtitle

Key ideas and learning outcomes

- Write Turing machines for propositional logic,
- Comment your code!
- Work on your assignment.

Relevant lectures: Turing machine slides

Relevant reading: Linked in the Turing section on learn.

Hand in exercises: 7 and 8

### Tutorial Exercises

#### 1. Negation.

Input: Single bit.

Output: Single bit, the negation of the input bit.

Test: Input = 1 Output = 0

#### 2. Disjunction of two bits.

Input: Two bits.

Output: Single bit, the disjunction of the input bits.

Test: Input = 10 Output = 1

#### 3. Conjunction of two bits.

Input: Two bits.

Output: Single bit, the conjunction of the input bit.

Test: Input = 10 Output = 0

#### 4. Implication.

Input: Two bits  $(b_1 b_2)$ .

Output: Single bit, representing  $v(b_1 \rightarrow b_2)$ .

Test: (i) Input = 10 Output = 0 (ii) Input = 00 Output = 1.

#### 5. Bitwise-ORs of two binary strings.

Input: two space separated equal length binary strings.

Output: a binary string corresponding to the bitwise OR of input strings.

Test: (i) Input = 10 10 Output = 10 (ii) Input = 10 01 Output = 11.

6. Bitwise-ANDs of two binary strings.

Input: Two space separated equal length binary strings.

Output: Binary string corresponding to the bitwise AND of the input strings.

Test: (i) Input = 01 10 Output = 00 (ii) Input = 01 01 Output = 01.

7. Disjunction of  $n$ -bits.

Input: One finite binary string.

Output: Single bit corresponding to the disjunction of input bits.

Test: Input = 1010101110 Output = 1.

8. Conjunction of  $n$ -bits.

Input: One finite binary string.

Output: Single bit corresponding to the conjunction of input bits.

Test: Input = 1010101110 Output = 0.