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Department of Mathematics

# MA0301 Elementary discrete mathematics Spring 2018

## Exercise 1

### Section 2.1

- [3] Let  $p, q$  be the primitive statements for which the implication  $p \rightarrow q$  false. Determine the truth values for each of the following:

b)  $\neg p \vee q$

d)  $\neg q \rightarrow \neg p$

- [8] Construct a truth table for each of the following compounded statements, where  $p, q, r$  denote primitive statements.

a)  $(p \rightarrow q) \rightarrow (q \rightarrow p)$

b)  $[p \wedge (p \rightarrow q)] \rightarrow q$

c)  $(p \wedge q) \rightarrow p$

d)  $q \leftrightarrow (\neg p \vee \neg q)$

e)  $[(p \rightarrow q) \wedge (q \rightarrow r)] \rightarrow (p \rightarrow r)$

- [15] The integer variables  $m$  and  $n$  are assigned the values 3 and 8, respectively, during the execution of a program. Each of the following *successive* statements is then encountered during program execution. What are the values of  $m, n$  after each of these statements are encountered?

a)

```
if  $n - m = 5$  then  
   $n := n - 2$   
end if
```

b)

```
if  $(2 * m = n)$  and  $(\lfloor n/4 \rfloor = 1)$  then  
   $n := 4 * m - 3$   
end if
```

- c)
- ```

if  $(n < 8)$  or  $(\lfloor m/2 \rfloor = 3)$  then
   $n := 4 * m - 3$ 
else
   $m = 2 * n$ 
end if

```
- d)
- ```

if  $(m < 20)$  and  $(\lfloor n/6 \rfloor = 1)$  then
   $m := m - n - 5$ 
end if

```
- e)
- ```

if  $((n = 2 * m) \text{ or } (\lfloor n/2 \rfloor = 5))$  then
   $n := 4 * m - 3$ 
end if

```

## Section 2.2

- [6] Negate each of the following and simplify the resulting statement

b)  $(p \wedge q) \rightarrow r$

c)  $p \vee q \vee (\neg p \wedge \neg q \wedge r)$

- [7] a) If  $p, q$  are primitive statements, prove that

$$(\neg p \vee q) \wedge (p \wedge (p \wedge q)) \leftrightarrow (p \wedge q)$$

- b) Write the dual of the logical equivalence in a).

- [18] Give the reasons for each step in the following simplifications of compound statements

|    |                                                                                                                                                                   |                |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| a) | $[(p \vee q) \wedge (p \vee \neg q)] \vee q$ $\Leftrightarrow [p \vee (q \wedge \neg q)] \vee q$ $\Leftrightarrow (p \vee F_0) \vee q$ $\Leftrightarrow p \vee q$ | <b>Reasons</b> |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|