COMP110 EXERCISE SHEET II: LOGIC GATES

Version 1.0
BSc Computing for Games
COMP110

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To complete this exercise sheet:

- **complete** the following problems using **pen and paper**; and
- **hand in** your solutions in the COMP110 workshop session in week 5.

1. Write out the truth tables for the following boolean expressions, for all possible values of boolean variables $A, B, C, \ldots$:
   (a) A AND B AND NOT C
   (b) A AND NOT (B AND NOT C)
   (c) (A OR NOT B) AND (A OR C)
   (d) A AND NOT (B OR NOT C) AND (NOT A AND D)
2. Draw logic circuits for each of the expressions in Question 1.
3. Use truth tables to show that the following identities hold:
   (a) NOT (A OR B) = NOT A AND NOT B
   (b) NOT (A AND B) = NOT A OR NOT B
   (c) (A AND B) OR (A AND C) = A AND (B OR C)
   (d) (A OR B) AND (A OR C) = A OR (B AND C)
4. Explain, using the identities in Question 3 and/or truth tables, why each of the following pairs of programs is equivalent:
   (a)

```
if not(file_exists("a.txt") and file_exists("b.txt")):
    print("A required file is missing")
```

```
if not file_exists("a.txt") or not file_exists("b.txt"):
    print("A required file is missing")
```

   (b)

```
if (type(x) == int and x > 7) or (type(x) == float and x > 7):
    print("Hello")
```

```
if (type(x) == int or type(x) == float) and x > 7:
    print("Hello")
```

   (c)

```
if x == 0 and y == 0:
    do_something()
else:
    print("Do nothing")
```

```
if x != 0 or y != 0:
    print("Do nothing")
else:
    do_something()
```

   (d)

```
if x > 10 or (x > 0 and y > 0):
    do_something()
```

```
if x > 0 and (x > 10 or y > 0):
    do_something()
```