Data, Logic, and Computing

ECS 17 (Winter 2026)

Patrice Koehl
koehl@cs.ucdavis.edu

January 9, 2026

Homework 2

Exercise 1

- *What is the binary representation of the hexadecimal 7C?*

  #7C = $(1111100)_2$

- *What is the hexadecimal representation of the binary number 1110101?*

  $(1100111)_2$ = #75

- *How many bits are there in 22 bytes?*

  A byte contains 8 bits; therefore, there are 176 bits in 22 bytes.

- *What is the largest unsigned integer that can be stored on one byte?*

  One byte contains 8 bits. Therefore the largest signed integer is $(11111111)_2$, which is 255.

Exercise 2

- *Let A be the binary number 1110110 and B the binary number 11100010; find the binary number C that satisfies $A + C = B$.*

  We proceed in 3 steps:

  a) Compute the decimal representation of A and B:
  $A = (1110110)_2 = 118$
  $B = (11100010)_2 = 226$

  b) Solve $A + C = B$
  $C = B - A = 108$

  c) Compute the binary representation of C:
  $C = (1101100)_2$

- *Let A be the hexadecimal number #3FF and B the hexadecimal number #F4F; find the hexadecimal number C that satisfies $A + C = B$.*

  We proceed in 3 steps:

a) Compute the decimal representation of A and B:
$A = \#3FF = 1023$
$B = \#F4F = 3919$

b) Solve $A + C = B$
$C = B - A = 2896$

c) Compute the hexadecimal representation of C:
$C = \#B50$

- *Let A be the hexadecimal number $\#3EF$ and B the binary number 10000000000; find the hexadecimal number C that satisfies $A + C = B$.*

We proceed in 3 steps:

a) Compute the decimal representation of A and B:
$A = \#3EF = 1007$
$B = (10000000000)_2 = 1024$

b) Solve $A + C = B$
$C = B - A = 17$

c) Compute the hexadecimal representation of C:
$C = \#11$

- *Let A be the binary number 1000000000 and B the hexadecimal number $\#227$; find the binary number C that satisfies $A + C = B$.*

We proceed in 3 steps:

a) Compute the decimal representation of A and B:
$A = (1000000000)_2 = 512$
$B = \#227 = 551$

b) Solve $A + C = B$
$C = B - A = 39$

c) Compute the binary representation of C:
$C = (100111)_2$

Exercise 3

We are on the island of knights and knaves . You meet three residents, Alex, Bill, and Claudia who make the following statements:

Alex says: "Bill is a knave and Claudia is a knight"
Bill says: "Claudia is a knight and Alex is a knight"
Claudia says: "I like cookies"

Does Claudia really like cookies?

We check all possible "values" for Alex, Bill, and Claudia, as well as the veracity of their statements.

We can eliminate:

Line number	Alex	Bill	Claudia	Alex says	Bill says
1	Knight	Knight	Knight	F	T
2	Knight	Knight	Knave	F	F
3	Knight	Knave	Knight	T	T
4	Knight	Knave	Knave	F	F
5	Knave	Knight	Knight	F	F
6	Knave	Knight	Knave	F	F
7	Knave	Knave	Knight	T	F
8	Knave	Knave	Knave	F	F

- Line 1, as Alex would be a knight but he lies
- Line 2, as Alex would be a knight but he lies
- Line 3 as Bill would be a knight but he lies
- Line 4 as Alex would be a knight but he lies
- Line 5 as Bill would be a knight but he lies
- Line 6 as Bill would be a knight but he lies
- Line 7 as Alex would be a knave but he says the true

Therefore all three are knaves. Claudia then lies: she does not like cookies!

Exercise 4

A very special island is inhabited only by knights and knaves. Knights always tell the truth, and knaves always lie. You meet three inhabitants: Alex, John and Sally. Alex says, "At least one of the following is true: that Sally is a knave or that I am a knight." John says, "Alex could claim that I am a knave." Sally claims, "Neither Alex nor John are knights." Can you find who is a knight and who is a knave?

We check all possible "values" for Alex, John and Sally, as well as the veracity of their statements.

We can eliminate:

- Line 1, as John would be a knight but he lies
- Line 2, as John would be a knight but he lies
- Line 3 as John would be a knave but he says the true
- Line 4 as John would be a knave but he says the true
- Line 5 as Sally would be a knight but she lies
- Line 6 as Alex would be a knave but he says the true

Line number	Alex	John	Sally	Alex says	John says	Sally says
1	Knight	Knight	Knight	T	F	F
2	Knight	Knight	Knave	T	F	F
3	Knight	Knave	Knight	T	T	F
4	Knight	Knave	Knave	T	T	F
5	Knave	Knight	Knight	F	T	F
6	Knave	Knight	Knave	T	T	F
7	Knave	Knave	Knight	F	F	T
8	Knave	Knave	Knave	T	F	T

- Line 8 as Alex would be a knave but he says the true

Line 7 is valid, and it is the only one. Therefore, both Alex and John are knaves, while Sally is a knight.

Exercise 5

We are on the island of knights and knaves . You meet two residents, Alex, Bill who make the following statements:

Alex says: "One of us, and only one of us, is a knight"
Bill says: "Only a knave would say that Alex is a knave"

Can you find out what Alex and Bill are?

We check all possible "values" for Alex and Bill, as well as the veracity of their statements. Note that what Bill says can be interpreted as "Alex is a knight".

Line number	Alex	Bill	Alex says	Bill says
1	Knight	Knight	F	T
2	Knight	Knave	T	T
3 Knave	Knight	T	F	
4 Knave	Knave	F	F	

We can eliminate:

- Line 1, as Alex would be a knight that lies
- Line 2, as Bill would be a knave that tells the truth
- Line 3 as Alex would be a knave that tells the truth

Line 4 is valid, and it is the only one. Therefore, both Alex and Bill are knaves.