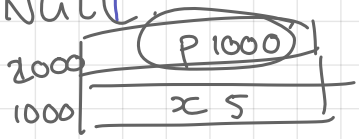
Week 1

Question 9.

int x ; // variable at address 1000 with initial value 0.
int *p; // variable at address 2000 with initial value 0.

	statement	x value	p value ("p points to")	x address	p address ("address of")
initial.	-	0	0	1000	2000
a.	p = &x;	0	1000	1000	2000
b.	x = 5;	5	1000	1000	2000
c.	*p = 3;	3	1000	1000	2000
d	x = (int) p; (typecast)	1000	1000	1000	2000
e.	x = (int) &p;	2000	1000	1000	2000
f.	p = NULL;	?2000	NULL	1000	2000
g.	*p = 1;	fail because &p = 2000	p is NULL		



Question 6.

when to use * and/or malloc for structs?

struct node a;

See code q6.

struct node *b;

what does malloc do?

Struct can hold different variable types	array only one type
fields are accessed by names	fields are accessed by indexes

Week 2

int → any # of bytes (at least 2 bytes)

1. When should the types in **stdint.h** be used?

=> what is the type **uint8_t**? (unsigned, 8 bits)
unsigned int that is 8 bits

how is it different to **int8_t**?
↑ not unsigned

2. How are the bases [decimal (base 10), hexadecimal (base 16), octal (base 8) and binary (base 2)] denoted in C?

- hexadecimal: starts with 0x
- octal: starts with 0
- decimal: any other case
- binary: → 0b → not standard → don't use !!

	decimal	binary	octal	hexadecimal
a.	1	0 0 0 0 0 0 0 1	0 0 1	0 1
b.	8	0 0 0 0 1 0 0 0	0 1 0	0 8
c.	10			
d.	15	0 0 0 0 1 1 1 1 ($1\cdot2^0 + 1\cdot2^2 + 1\cdot2^1 + 1\cdot2^0$)	0 1 7	0 F
e.	16			
f.	100			
g.	127			
h.	200			

15
7 r 1
3 r 1
1 r 1
0 r 1

Decimal	Hexadecimal	Binary
0	0	0000
1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	1000
9	9	1001
10	A	1010
11	B	1011
12	C	1100
13	D	1101
14	E	1110
15	F	1111

decimal → binary (by hand)

(÷2) 8
4 r 0
2 r 0
1 r 0
0 r 1

$8_{10} = 001000_2 = 8_{16} = 10_8$

$_{10}$ means base 10

1

$_2$ means base 2

binary → hex

4 digits of binary are equal to 1 digit in hex. (hexadecimal)

1 1 1 1
$2^3+2^2+2^1+2^0$ (bin ⇒ dec)
15 = F

1 0 1 1
$2^3\times1+2^2\times0+2^1\times1+2^0\times1$

binary → octal

same as bin → hex but 3 digits

$111_2 = 7$

3. Bitwise Operations

	A	B	OR |	AND &	XOR ^
1.	0	0	0	0	0
2.	0	1	1	0	1
3.	1	0	1	0	1
4.	1	1	1	1	0
	True = 1 False = 0		at least one is 1	need both to be 1	only one can be 1

A	NOT ~
0	1
1	0
	invert the input

a) $0x5555 \mid 0xAAAA$

0101 0101 0101 0101
1010 1010 1010 1010
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

$0xFFFF$

b) $0x5555 \,\&\, 0xAAAA$

0101 0101 0101 0101
1010 1010 1010 1010
&
0 0 0 0

$0x0000$

c) $0x5555 \,\hat{}\, 0xAAAA$

0101 0101 0101 0101
1010 1010 1010 1010
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

$0xFFFF$

d) $0x5555 \,\&\, \sim 0xAAAA$

0101 0101 0101 0101
AAAA: 1010 1010 1010 1010 &
$\sim$AAAA = 0101 0101 0101 0101
0101 0101 0101 0 0 0 0

$0x5555$

e) $0x0001 << 6$

bitwise shift (to) left

0000 0000 0000 0001
00 0000 0001 00 0000

pad w/ 0's

f) $0x5555 >> 4$ (shift right)

always use unsigned vars!!

0101 0101 0101 0101
0000 0101 0101 0101

g) $0x5555 \,\&\, (0xAAAA << 1)$

h) $0xAAAA \mid 0x0001$

i) $0xAAAA \,\&\, \sim 0x0001$

1000
2^3

Given a variable **X**...

Copy/extract the value of a specific bit: X & mask

Set a specific bit to 1: X | mask

Set a specific bit to 0: X & ~mask.

invert a specific bit: X ^ mask

set a specific bit to 1.

	0011	0000
mask:	0000	0100
want:	0011	0100
|:	0011	0100

want to set the original value to 1 @ this digit

^ ↳ good

	0011	0100
	0000	0100
^	0011	0000

is a^b == a & ~b ?

a	b	~b	a^b	a & ~b
0	0	1	0	0
0	1	0	1	0
1	0	1	1	1
1	1	0	0	0

(2)

no, they're different (2)

0000 0 . 1001

1000 0000 0

00000 = 0

1000

i = 31
extract = 31
setting = 31-31 = 0

i = 28
extract = 28
Setting = 31-28 = 3

set a specific bit to 0.

a	orig	0110	1000
b	mask	0010	0001
		0100	1000
	~b	1101	1110
	a&(~b)	0100	1000

copy specific bit:

orig	0110	1010
mask	0011	0000
want:	0010	0000
try &	0010	0000