1st case:
a and b operants are positive:

$$
\begin{array}{r}
+\ 3 \\
7 \\
\hline
10
\end{array}
\qquad
\begin{array}{r}
0\ 0000011 \\
0\ 0000111 \\
\hline
0\ 0001010
\end{array}
$$

2nd case:

1st number is +

2nd number is −

$$
\begin{array}{r}
+\ 3 \\
(-10) \\
\hline
-7
\end{array}
\qquad
\begin{array}{r}
0\ 0000011 \\
+\ 1\ 1110101 \\
\hline
1\ 1111000
\end{array}
$$

→ m'sinyi olduğun
göstriz

$$10 \div 2 = 5,\ \text{remainder } 0$$
$$5 \div 2 = 2,\ \text{remainder } 1$$
$$2 \div 2 = 1,\ \text{remainder } 0$$
$$1$$

00001010

11110101

$$3 \div 2 = 1,\ \text{remainder } 1$$
$$1$$

3rd case:

1st number is −

2nd number is −

absolute value of

2^{nd} number is less than 1^{st} number

$$\begin{array}{r} 10 \\ + \; -3 \\ \hline 7 \end{array} \qquad \begin{array}{r} 0\ 0001010 \\ + \; 1\ 1111100 \\ \hline \boxed{1}\ 0\ 0000110 \\ + \qquad\qquad 1 \\ \hline 0\ 0000111 \end{array}$$

carry bit

$3 \rightarrow 0\ 0000011$

$-3 \rightarrow 1\ 1111100$

4th case:

1st number is –

2nd number is

$$
\begin{array}{r}
-3 \\
+\;-7 \\
\hline
-10
\end{array}
\qquad
\begin{array}{r}
1\;\;111110\,0 \\
+\;1\;\;1111000 \\
\hline
\cancel{1}\,1\;\;1110100 \\
1 \\
\hline
1\;\;1110101
\end{array}
$$

$$
\begin{array}{r|l}
7 & 2 \\
-6 & 3 \;|\; 2 \\
1 & -2 \quad 1 \\
 & 1 \quad 1
\end{array}
$$

0 0000111

1 1111000

Cases of the overflow:

1st case:

a and b are +

$$A+B >= 2^{n-1}$$

in our case

$n = 8$ and $2^{n-1} = 128$

$$\begin{array}{r} 65 \\ +\,97 \\ \hline 162 \end{array} \qquad \begin{array}{r} 0\ 1000001 \\ 0\ 1100001 \\ \hline 1\ 0100010 \end{array}$$

$\downarrow$ sum is $-$

but we added two $+$ numbers.

signs are different.

we have overflow in this case.

2nd case

A and B are

The sum of absolute values of A and B is $>= 2^{n-1}$

$$\begin{array}{r} -63 \\ + \; -85 \\ \hline 158 \end{array} \qquad \begin{array}{rr} 1 & 10000000 \\ +1 & 01000000 \\ \hline 1 \; 0 & 11000000 \\ \hline 1 \; > & 1 \\ \hline \end{array}$$

carry bit

it's overflow too but idk why :-)

sign magnitude

$$\begin{array}{r} 2 \\ +\;-8 \\ \hline -11 \end{array} \qquad \begin{array}{r} 0\;\;0000010 \\ +\;1\;\;1110110 \\ \hline 1\;\;1111000 \end{array}$$

$$\begin{array}{r|l} 8 & 2 \\ -8 & 4 \\ \hline 1 & \end{array} \quad \begin{array}{r|l} 4 & 2 \\ -4 & 2 \\ \hline 0 & \end{array} \quad \begin{array}{r|l} 2 & 2 \\ -2 & 1 \\ \hline 0 & \end{array}$$

1 0000 1001

çevir

1 111 0110

-20

-10

20 | 2
-20 | 10 | 2
0 -10 | 5 | 2
0 -4 | 2 | 2
1 -2 | 1
0
1

0 0000101
1 1111010

10 | 2
-10 | 5 | 2
0 -4 | 2 | 2
1 -2 | 1
0
1

0000 1010

11110101

1 1111010

1 1110101

1 1101111

31 401

\+

1

10000

? ? ? ?

-120

$+ \; 15$

$-$

$$
\begin{array}{l}
120 \,|\, 2 \\
-120 \quad 60 \,|\, 2 \\
0 \quad -60 \quad 30 \,|\, 2 \\
0 \quad -30 \quad 15 \,|\, 2 \\
0 \quad -14 \quad 7 \,|\, 2 \\
1 \quad -6 \quad 3 \,|\, 2 \\
1 \quad -2 \quad 1 \\
1 \quad 1
\end{array}
$$

0 0001111

1 1110000

$$
\begin{array}{l}
15 \,|\, 2 \\
-14 \quad 7 \,|\, 2 \\
 2
\end{array}
$$

1 63 | 2
1 6 1
1 2
1 1

0 0001111

1 1110000

1 1110000
1 1110000

1 1100000

1

120+15=135>128
overflow

two's complement

two's complement
addiction.

1^{st} case:

1^{st} num is +

2^{nd} num is −

abs value of 2^{nd} number is > than 1^{st} number.

	3	0 0000011
+	-10	+ 1 1110110
	-7	[illegible]

d 1 1111001

10 | 2
−10 | 5 | 2
0 −4 | 2 | 2
1 −2 | 1
0
1

one's com
tap
üstünə 1 gəl
= two's comp.

0000 1010

1111 0101

+ 1

1111 0110

2nd case:

1st is +

2nd is −

$$\begin{array}{r} 10 \\ + \ -3 \\ \hline 7 \end{array} \qquad \begin{array}{r} 0\ 0001010 \\ +\ 1\ 1111101 \\ \hline 1\ \ 0\ 0000111 \end{array}$$

'1' carry bit is discarded

3rd case

A and B are −

$$\begin{array}{r} -3 \\ + \ -7 \\ \hline -10 \end{array} \qquad \begin{array}{r} 1\ \ 1111101 \\ +\ 1\ \ 1111001 \\ \hline 1\ 1110110 \end{array}$$

$\leftarrow$ 1

sign bit.

0 0000 0111

1 1111 1000

+ 1

1 1 1 1 1 1 0 0 1

Exercise

two's comp.

2

+ -8

$$
\begin{array}{r|l}
9 & 2 \\
-8 & 4 \\
1 &
\end{array}
\qquad
\begin{array}{r|l}
4 & 2 \\
-4 & 2 \\
0 &
\end{array}
\qquad
\begin{array}{r|l}
2 & 2 \\
-2 & 1 \\
0 &
\end{array}
$$

1

0. 0001001

1 1110110

+

1 1110111

\+ 0 0000010

1 1111001

-5

1 -7

0 0000101

1 1111010

\+ 1

---

1 1111011

\+ 1 1111001

---

1 11110100

-126

$+ \ -1$

$$
\begin{array}{l}
126 \mid 2 \\
-126 \mid 63 \mid 2 \\
\quad 0 \quad -62 \mid 31 \mid 2 \\
\qquad\quad 1 \quad -30 \mid 15 \mid 2 \\
\qquad\qquad\quad 1 \quad -14 \mid 7 \mid 2 \\
\qquad\qquad\qquad\quad 1 \quad -6 \mid 3 \mid 2 \\
\qquad\qquad\qquad\qquad\quad 1 \quad -2 \mid 1 \\
\qquad\qquad\qquad\qquad\qquad\quad 1 \quad 1
\end{array}
$$

0 0111111

1 1000000

\+ 1

---

1 1000001

0 0000001

1 1111110

\+ 1

---

1 1111111

1 1000001

---

1 1000000

1

1 80

-127

$-1 \quad -1$

1 70

$$
\begin{array}{r|l}
127 & 2 \\
-126 & 64 \\
\hline
1 &
\end{array}
\quad
\begin{array}{r|l}
64 & 2 \\
-64 & 32 \\
\hline
0 &
\end{array}
\quad
\begin{array}{r|l}
32 & 2 \\
-32 & 16 \\
\hline
0 &
\end{array}
\quad
\begin{array}{r|l}
16 & 2 \\
-16 & 8 \\
\hline
0 &
\end{array}
\quad
\begin{array}{r|l}
8 & 2 \\
-8 & 4 \\
\hline
0 &
\end{array}
\quad
\begin{array}{r|l}
4 & 2 \\
-4 & 2 \\
\hline
0 &
\end{array}
\quad
\begin{array}{r|l}
2 & 2 \\
-2 & 1 \\
\hline
0 & 1
\end{array}
$$

1 0000001

0 1111110

1

+ 1

0 1 1 1 1 1 1 1

+ 1 1 1 1 1 1 1 1

0