

Tracing While Loops



Consider...

```
int i = 4, j = 1, n = 0;
while (i > j) {
    if (n % 2 == 0) {
        i--;
    } else {
        j++;
    }
    n++;
}
```

Trace It

<code>int i = 4, j = 1, n = 0;</code>	
	<i>i = 4 j = 1 n = 0</i>
<code>while (i > j) {</code>	
<code>if (n % 2 == 0) {</code>	
<code>i--;</code>	
<code>} else {</code>	
<code>j++;</code>	
<code>}</code>	
<code>n++;</code>	
<code>}</code>	

Trace It

<code>int i = 4, j = 1, n = 0;</code>	
	<i>i = 4 j = 1 n = 0</i>
<code>while (i > j) {</code>	
	<i>i = 4 j = 1 n = 0</i>
<code>if (n % 2 == 0) {</code>	
<code>i--;</code>	
<code>} else {</code>	
<code>j++;</code>	
<code>}</code>	
<code>n++;</code>	
<code>}</code>	

Trace It

<code>int i = 4, j = 1, n = 0;</code>	
	<i>i = 4 j = 1 n = 0</i>
<code>while (i > j) {</code>	
	<i>i = 4 j = 1 n = 0</i>
<code>if (n % 2 == 0) {</code>	
	<i>i = 4 j = 1 n = 0</i>
<code>i--;</code>	
<code>} else {</code>	
<code>j++;</code>	
<code>}</code>	
<code>n++;</code>	
<code>}</code>	

Trace It

<code>int i = 4, j = 1, n = 0;</code>	
	<i>i = 4 j = 1 n = 0</i>
<code>while (i > j) {</code>	
	<i>i = 4 j = 1 n = 0</i>
<code>if (n % 2 == 0) {</code>	
	<i>i = 4 j = 1 n = 0</i>
<code>i--;</code>	
	<i>i = 3 j = 1 n = 0</i>
<code>} else {</code>	
<code>j++;</code>	
<code>}</code>	
<code>n++;</code>	
<code>}</code>	

Trace It

<code>int i = 4, j = 1, n = 0;</code>	
	<i>i = 4 j = 1 n = 0</i>
<code>while (i > j) {</code>	
	<i>i = 4 j = 1 n = 0</i>
<code>if (n % 2 == 0) {</code>	
	<i>i = 4 j = 1 n = 0</i>
<code>i--;</code>	
	<i>i = 3 j = 1 n = 0</i>
<code>} else {</code>	
	<i>i = - j = - n = -</i>
<code>j++;</code>	
	<i>i = - j = - n = -</i>
<code>}</code>	
	<i>i = 3 j = 1 n = 0</i>
<code>n++;</code>	
<code>}</code>	

Trace It

<code>int i = 4, j = 1, n = 0;</code>	
	<i>i = 4 j = 1 n = 0</i>
<code>while (i > j) {</code>	
	<i>i = 4 j = 1 n = 0</i>
<code>if (n % 2 == 0) {</code>	
	<i>i = 4 j = 1 n = 0</i>
<code>i--;</code>	
	<i>i = 3 j = 1 n = 0</i>
<code>} else {</code>	
	<i>i = - j = - n = -</i>
<code>j++;</code>	
	<i>i = - j = - n = -</i>
<code>}</code>	
	<i>i = 3 j = 1 n = 0</i>
<code>n++;</code>	
	<i>i = 3 j = 1 n = 1</i>
<code>}</code>	

Trace It

<code>int i = 4, j = 1, n = 0;</code>	
	<i>i = 4 j = 1 n = 0</i>
<code>while (i > j) {</code>	
	<i>i = 4 3 j = 1 1 n = 0 1</i>
<code> if (n % 2 == 0) {</code>	
	<i>i = 4 j = 1 n = 0</i>
<code> i--;</code>	
	<i>i = 3 j = 1 n = 0</i>
<code> } else {</code>	
	<i>i = - j = - n = -</i>
<code> j++;</code>	
	<i>i = - j = - n = -</i>
<code> }</code>	
	<i>i = 3 j = 1 n = 0</i>
<code> n++;</code>	
	<i>i = 3 j = 1 n = 1</i>
<code>}</code>	

Trace It

<code>int i = 4, j = 1, n = 0;</code>	
	<i>i = 4 j = 1 n = 0</i>
<code>while (i > j) {</code>	
	<i>i = 4 3 j = 1 1 n = 0 1</i>
<code> if (n % 2 == 0) {</code>	
	<i>i = 4 - j = 1 - n = 0 -</i>
<code> i--;</code>	
	<i>i = 3 - j = 1 - n = 0 -</i>
<code> } else {</code>	
	<i>i = - 3 j = - 1 n = - 1</i>
<code> j++;</code>	
	<i>i = - j = - n = -</i>
<code> }</code>	
	<i>i = 3 j = 1 n = 0</i>
<code> n++;</code>	
	<i>i = 3 j = 1 n = 1</i>
<code>}</code>	

Trace It

<code>int i = 4, j = 1, n = 0;</code>	
	$i = 4 \quad j = 1 \quad n = 0$
<code>while (i > j) {</code>	
	$i = \cancel{4} \ 3 \quad j = \cancel{1} \ 1 \quad n = \cancel{0} \ 1$
<code> if (n % 2 == 0) {</code>	
	$i = \cancel{4} \ - \quad j = \cancel{1} \ - \quad n = \cancel{0} \ -$
<code> i--;</code>	
	$i = \cancel{3} \ - \quad j = \cancel{1} \ - \quad n = \cancel{0} \ -$
<code> } else {</code>	
	$i = - \ 3 \quad j = - \ 1 \quad n = - \ 1$
<code> j++;</code>	
	$i = - \ 3 \quad j = - \ 2 \quad n = - \ 1$
<code> }</code>	
	$i = 3 \quad j = 1 \quad n = 0$
<code> n++;</code>	
	$i = 3 \quad j = 1 \quad n = 1$
<code>}</code>	

Trace It

<code>int i = 4, j = 1, n = 0;</code>	
	$i = 4 \quad j = 1 \quad n = 0$
<code>while (i > j) {</code>	
	$i = \cancel{4} \ 3 \quad j = \cancel{1} \ 1 \quad n = \cancel{0} \ 1$
<code> if (n % 2 == 0) {</code>	
	$i = \cancel{4} \ - \quad j = \cancel{1} \ - \quad n = \cancel{0} \ -$
<code> i--;</code>	
	$i = \cancel{3} \ - \quad j = \cancel{1} \ - \quad n = \cancel{0} \ -$
<code> } else {</code>	
	$i = - \ 3 \quad j = - \ 1 \quad n = - \ 1$
<code> j++;</code>	
	$i = - \ 3 \quad j = - \ 2 \quad n = - \ 1$
<code> }</code>	
	$i = \cancel{3} \ 3 \quad j = \cancel{1} \ 2 \quad n = \cancel{0} \ 1$
<code> n++;</code>	
	$i = 3 \quad j = 1 \quad n = 1$
<code>}</code>	

Trace It

<code>int i = 4, j = 1, n = 0;</code>	
	$i = 4 \quad j = 1 \quad n = 0$
<code>while (i > j) {</code>	
	$i = 4 \quad j = 1 \quad n = 0$
<code> if (n % 2 == 0) {</code>	
	$i = 4 \quad j = 1 \quad n = 0$
<code> i--;</code>	
	$i = 3 \quad j = 1 \quad n = 0$
<code> } else {</code>	
	$i = 3 \quad j = 1 \quad n = 0$
<code> j++;</code>	
	$i = 3 \quad j = 2 \quad n = 0$
<code> }</code>	
<code> n++;</code>	
	$i = 3 \quad j = 2 \quad n = 1$
<code>}</code>	

Trace It

<code>int i = 4, j = 1, n = 0;</code>	
	$i = 4 \quad j = 1 \quad n = 0$
<code>while (i > j) {</code>	
	$i = \cancel{4} \rightarrow 3 \quad j = \cancel{1} \rightarrow 2 \quad n = \cancel{0} \rightarrow 2$
<code> if (n % 2 == 0) {</code>	
	$i = \cancel{4} - \quad j = \cancel{1} - \quad n = \cancel{0} -$
<code> i--;</code>	
	$i = \cancel{3} - \quad j = \cancel{1} - \quad n = \cancel{0} -$
<code> } else {</code>	
	$i = - 3 \quad j = - 1 \quad n = - 1$
<code> j++;</code>	
	$i = - 3 \quad j = - 2 \quad n = - 1$
<code> }</code>	
	$i = \cancel{3} \rightarrow 3 \quad j = \cancel{1} \rightarrow 2 \quad n = \cancel{0} \rightarrow 1$
<code> n++;</code>	
	$i = \cancel{3} \rightarrow 3 \quad j = \cancel{1} \rightarrow 2 \quad n = \cancel{1} \rightarrow 2$
<code>}</code>	

Trace It

<code>int i = 4, j = 1, n = 0;</code>	
	$i = 4 \quad j = 1 \quad n = 0$
<code>while (i > j) {</code>	
	$i = \cancel{4} \rightarrow 3 \quad j = \cancel{1} \rightarrow 2 \quad n = \cancel{0} \rightarrow 2$
<code> if (n % 2 == 0) {</code>	
	$i = \cancel{4} - 3 \quad j = \cancel{1} - 2 \quad n = \cancel{0} - 2$
<code> i--;</code>	
	$i = \cancel{3} - \quad j = \cancel{1} - \quad n = \cancel{0} -$
<code> } else {</code>	
	$i = - 3 \quad j = - 1 \quad n = - 1$
<code> j++;</code>	
	$i = - 3 \quad j = - 2 \quad n = - 1$
<code> }</code>	
	$i = \cancel{3} \quad j = \cancel{1} \quad n = \cancel{0} \rightarrow 1$
<code> n++;</code>	
	$i = \cancel{3} \quad j = \cancel{1} \quad n = \cancel{1} \rightarrow 2$
<code>}</code>	

Trace It

<code>int i = 4, j = 1, n = 0;</code>	
	$i = 4 \quad j = 1 \quad n = 0$
<code>while (i > j) {</code>	
	$i = \cancel{4} - 3 \quad j = \cancel{1} - 2 \quad n = \cancel{0} - 2$
<code> if (n % 2 == 0) {</code>	
	$i = \cancel{4} - 3 \quad j = \cancel{1} - 2 \quad n = \cancel{0} - 2$
<code> i--;</code>	
	$i = \cancel{3} - 2 \quad j = \cancel{1} - 2 \quad n = \cancel{0} - 2$
<code> } else {</code>	
	$i = -3 \quad j = -1 \quad n = -1$
<code> j++;</code>	
	$i = -3 \quad j = -2 \quad n = -1$
<code> }</code>	
	$i = \cancel{3} \quad j = \cancel{1} \quad n = \cancel{0} \quad 1$
<code> n++;</code>	
	$i = \cancel{3} \quad j = \cancel{1} \quad n = \cancel{1} \quad 2$
<code>}</code>	

Trace It

<code>int i = 4, j = 1, n = 0;</code>	
	$i = 4 \quad j = 1 \quad n = 0$
<code>while (i > j) {</code>	
	$i = \cancel{4} \rightarrow 3 \quad j = \cancel{1} \rightarrow 2 \quad n = \cancel{0} \rightarrow 2$
<code> if (n % 2 == 0) {</code>	
	$i = \cancel{4} - 3 \quad j = \cancel{1} - 2 \quad n = \cancel{0} - 2$
<code> i--;</code>	
	$i = \cancel{3} - 2 \quad j = \cancel{1} - 2 \quad n = \cancel{0} - 2$
<code> } else {</code>	
	$i = - \cancel{3} - \quad j = - \cancel{1} - \quad n = - \cancel{1} -$
<code> j++;</code>	
	$i = - \cancel{3} - \quad j = - \cancel{2} - \quad n = - \cancel{1} -$
<code> }</code>	
	$i = \cancel{3} \rightarrow 2 \quad j = \cancel{1} \rightarrow 2 \quad n = \cancel{0} \rightarrow 2$
<code> n++;</code>	
	$i = \cancel{3} \rightarrow 3 \quad j = \cancel{1} \rightarrow 2 \quad n = \cancel{1} \rightarrow 2$
<code>}</code>	

Trace It

<code>int i = 4, j = 1, n = 0;</code>	
	$i = 4 \quad j = 1 \quad n = 0$
<code>while (i > j) {</code>	
	$i = \cancel{4} \rightarrow 3 \quad j = \cancel{1} \rightarrow 2 \quad n = \cancel{0} \rightarrow 2$
<code> if (n % 2 == 0) {</code>	
	$i = \cancel{4} - 3 \quad j = \cancel{1} - 2 \quad n = \cancel{0} - 2$
<code> i--;</code>	
	$i = \cancel{3} - 2 \quad j = \cancel{1} - 2 \quad n = \cancel{0} - 2$
<code> } else {</code>	
	$i = - \cancel{3} - \quad j = - \cancel{1} - \quad n = - \cancel{1} -$
<code> j++;</code>	
	$i = - \cancel{3} - \quad j = - \cancel{2} - \quad n = - \cancel{1} -$
<code> }</code>	
	$i = \cancel{3} \rightarrow 2 \quad j = \cancel{1} \rightarrow 2 \quad n = \cancel{0} \rightarrow 2$
<code> n++;</code>	
	$i = \cancel{3} \rightarrow 2 \quad j = \cancel{1} \rightarrow 2 \quad n = \cancel{1} \rightarrow 3$
<code>}</code>	

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<code>int i = 4, j = 1, n = 0;</code>	
	$i = 4 \quad j = 1 \quad n = 0$
<code>while (i > j) {</code>	
	$i = \cancel{4} \rightarrow 3 \quad j = \cancel{1} \rightarrow 2 \quad n = \cancel{0} \rightarrow 2$
<code> if (n % 2 == 0) {</code>	
	$i = \cancel{4} - 3 \quad j = \cancel{1} - 2 \quad n = \cancel{0} - 2$
<code> i--;</code>	
	$i = \cancel{3} - 2 \quad j = \cancel{1} - 2 \quad n = \cancel{0} - 2$
<code> } else {</code>	
	$i = - \cancel{3} - \quad j = - \cancel{1} - \quad n = - \cancel{1} -$
<code> j++;</code>	
	$i = - \cancel{3} - \quad j = - \cancel{2} - \quad n = - \cancel{1} -$
<code> }</code>	
	$i = \cancel{3} \rightarrow 2 \quad j = \cancel{1} \rightarrow 2 \quad n = \cancel{0} \rightarrow 2$
<code> n++;</code>	
	$i = \cancel{3} \rightarrow 2 \quad j = \cancel{1} \rightarrow 2 \quad n = \cancel{1} \rightarrow 3$
<code>}</code>	
	$i = 2 \quad j = 2 \quad n = 3$

What Does It Do?

- Describe in one short sentence what the snippet of code we just traced does.
- Don't repeat the code in English...