

$a + b$
 ~~$a = b$~~
 $a == b$
 $b \rightarrow -b$
 $a - b = 0$
 > 0
 < 0

```

if ( ??? ) {
    //
}
else {
    //
}

```

```

//
//
//
//
//
if
//
//

```

condition

```

if (x < 100) {
    System.out.printf("great, number %d given", x);
} else {
    System.out.printf("bad, %d given", x);
}

```

true

false

boolean = {true | false}

$a \parallel b$

OR

$a \& b$

AND

$!a$

NOT

$a \wedge b$

XOR

OR

a	b	$a \parallel b$
F	F	F
F	T	T
T	F	T
T	T	T

2x2

AND

a	b	$a \& b$
F	F	F
F	T	F
T	F	F
T	T	T

a	$!a$
T	F
F	T

T=0

T=1

T=1

T=2

a	b	$a \wedge b$	XOR
F	F	F	
F	T	T	
T	F	T	
T	T	F	

$a \parallel b \parallel c$

$(a \parallel b) \& c$

$$1 + 2 = 3$$

$$3 - 1 = 2$$

$$3 \times 2 = 6$$

$$\begin{array}{r} (1+2) - 3 = 0 \\ \underline{3} \\ 0 \end{array}$$

$$a + 0 = a$$

$$a \cdot 0 = 0$$

$$A \Rightarrow B$$

$$(a+b) \cdot c = a \cdot c + b \cdot c$$

$$a \parallel !a = \text{TRUE}$$

$$a \&\&!a = \text{FALSE}$$

$$(a \parallel b) \&\&c = \underline{a \&\&c} \parallel \underline{b \&\&c}$$

$$a \parallel \text{TRUE} = \text{TRUE}$$

$$a \&\&\text{TRUE} = a$$

$$a \parallel \text{FALSE} = a$$

$$a \&\&\text{FALSE} = \text{FALSE}$$

~~$$a \parallel (b \parallel !b) = \text{true}$$~~

~~$$a \&\&!a \&\& \dots = \text{false}$$~~


```
if (x > 100 && x < 1000) {  
    System.out.printf("great, number %d given", x);  
} else {  
    System.out.printf("bad, %d given", x);  
}
```

false

```
if (x < 100 && x > 1000) {  
    System.out.printf("great, number %d given", x);  
} else {  
    System.out.printf("bad, %d given", x);  
}
```

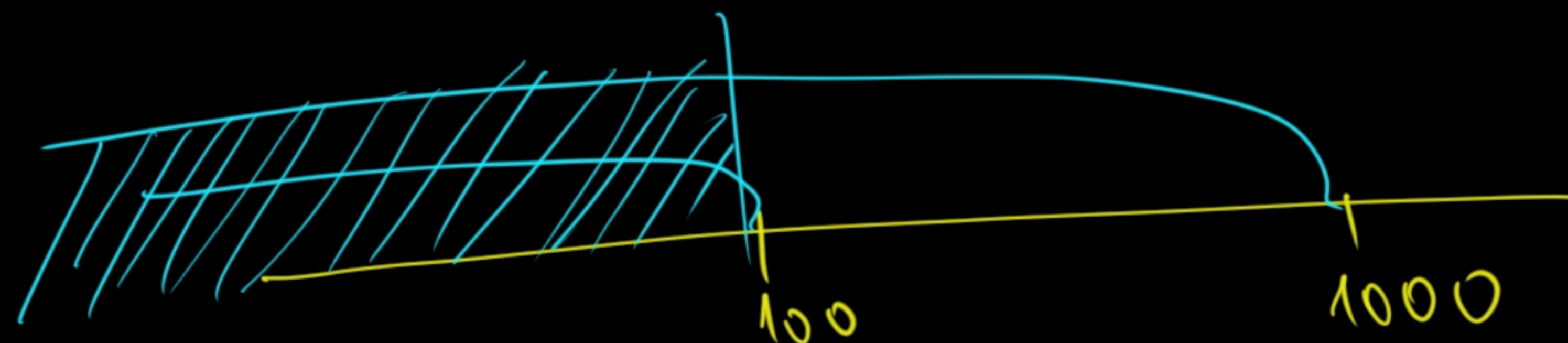
never

always

if (x < 100 && x < 1000)

↓

if (x < 100)




```
int k;

if (x < 100) {
    k = 1;
} else {
    k = 2;
}
```

→

```
int k = x < 100 ? 1 : 2;
```

T
F
1
2
3

problem

```
if (x < 100) {
    k = 1;
}
```

try (1) {
 } catch {
 } finally {
 }
 2
 3
 4

unary

$\neg a$
 $!a$

neg (int) → int
 inv (bool) → bool

add (int, int) → int
 2

binary

$a + b$
 $a - b$
 $a * b$
 a / b
 $a \wedge b$

ternary

cond ? if true : if false
 3

cond (bool, int, int) → int
 3

if ($x < 100$) ... //1

else if ($x > 100$ && $x < 1000$) ... //2

else if ($x > 1000$ && $x < 10000$) ... //3

else ... //4

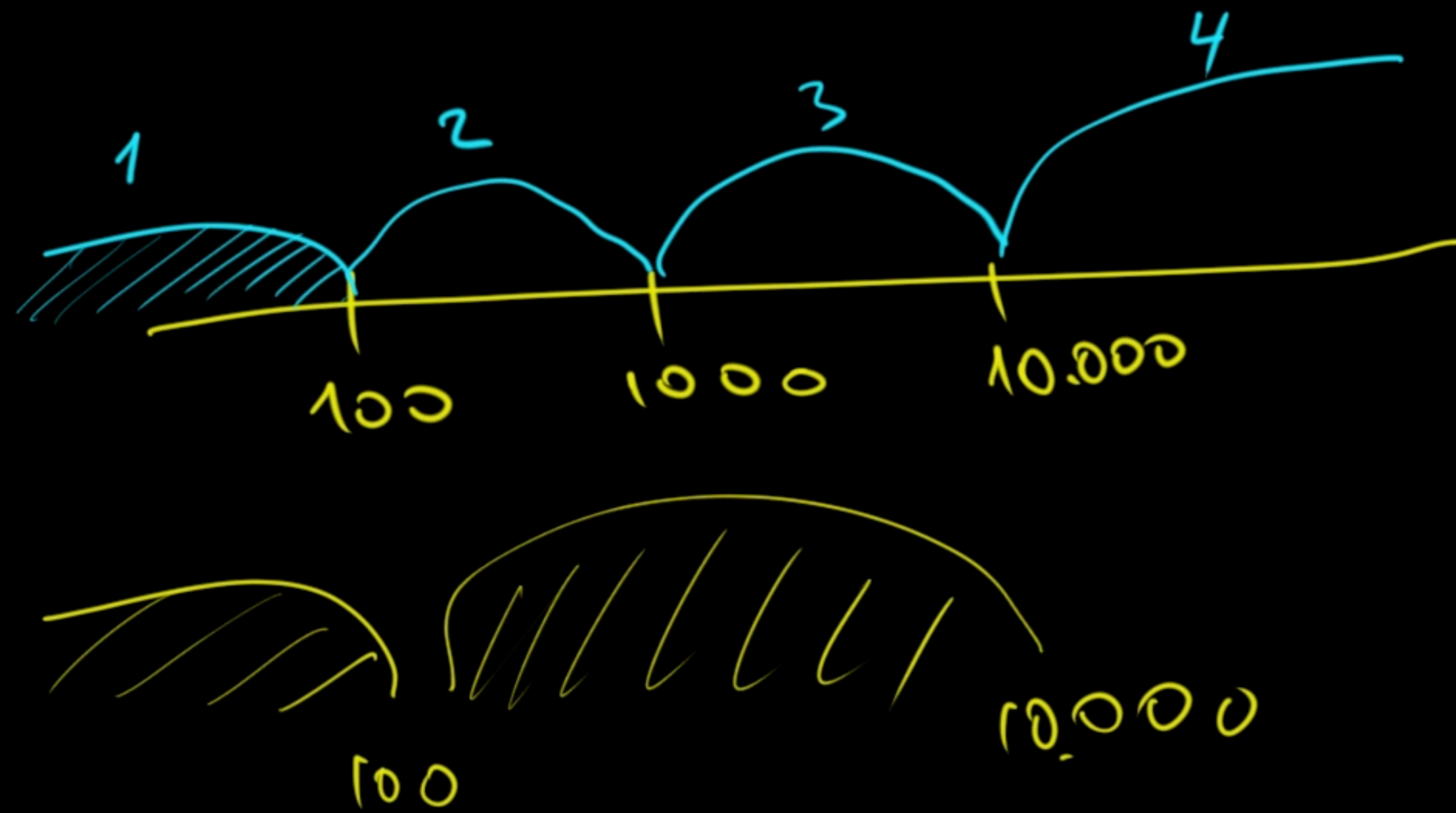


if ($x < 100$) ...

else if ($x < 1000$) ...

else if ($x < 10000$) ...

else ...





$x = \emptyset$
while (before
bool)

block 0+
 $x = x + 1$

do {

$x = next$ 1+

} while (bool)
after

if (bool) {

for ($x = 1$; $x < 10$; $x++$) {



}
 ~~}~~


```
while (x < 5) {
    System.out.println("hello");
    x++;
}
```

```
while (true) { ≡
    if (x >= 5) break;
    System.out.println("hello");
    x++;
}
```

```
while (true) {
    if (x >= 5) break;
    System.out.println("hello");
    x++;
    //
    if (x % 2 == 0) continue;
    //
    //
    //
}
```

```
for (int i = 1; i <= 5; i++) {
    System.out.println(i);
}
```

```
int i = 1;
while (i <= 5) {
    System.out.println(i);
    i++;
}
```

// i = 6

100%

```
int i = 1;
for (; i <= 5; i++) {
    System.out.println(i);
}
```

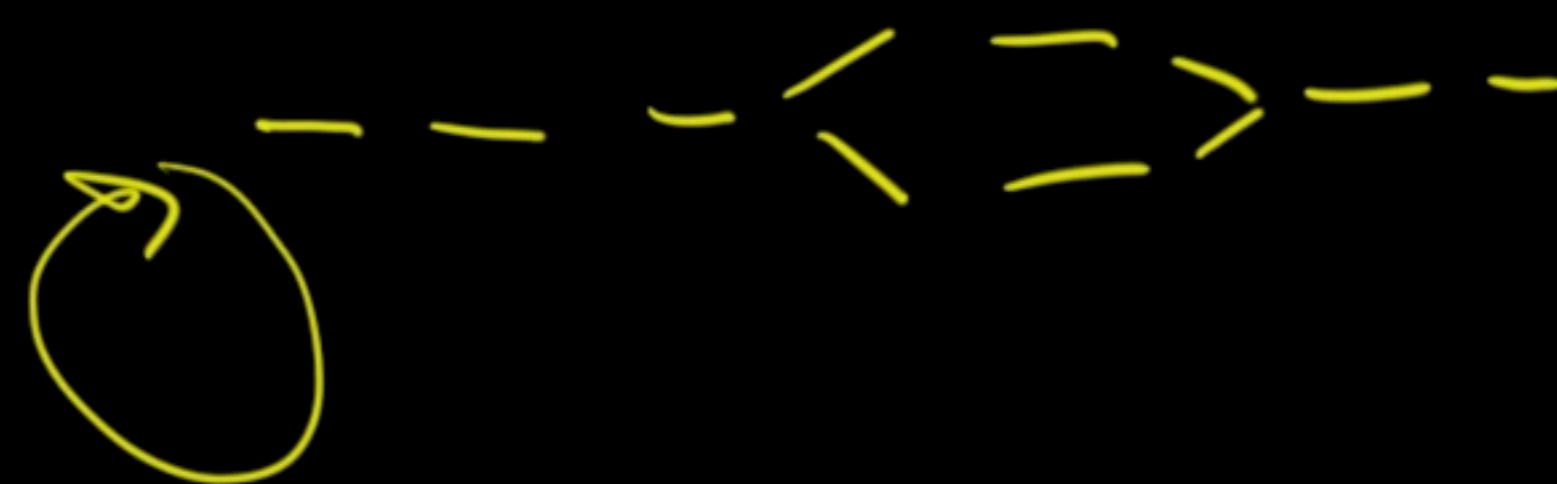
```
for (; ; i++) {
    if (i > 10) break;
    System.out.println(i);
}
```

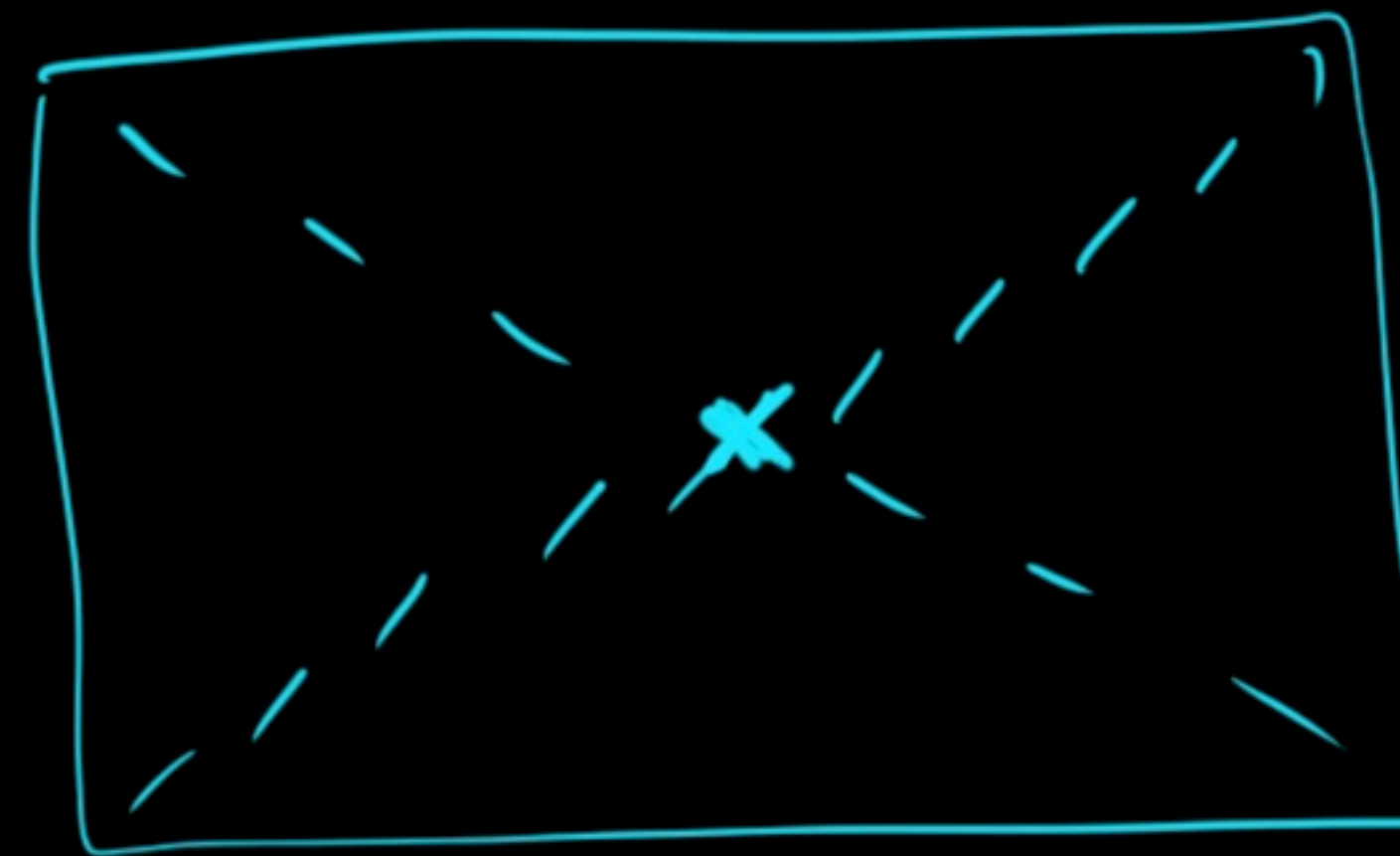
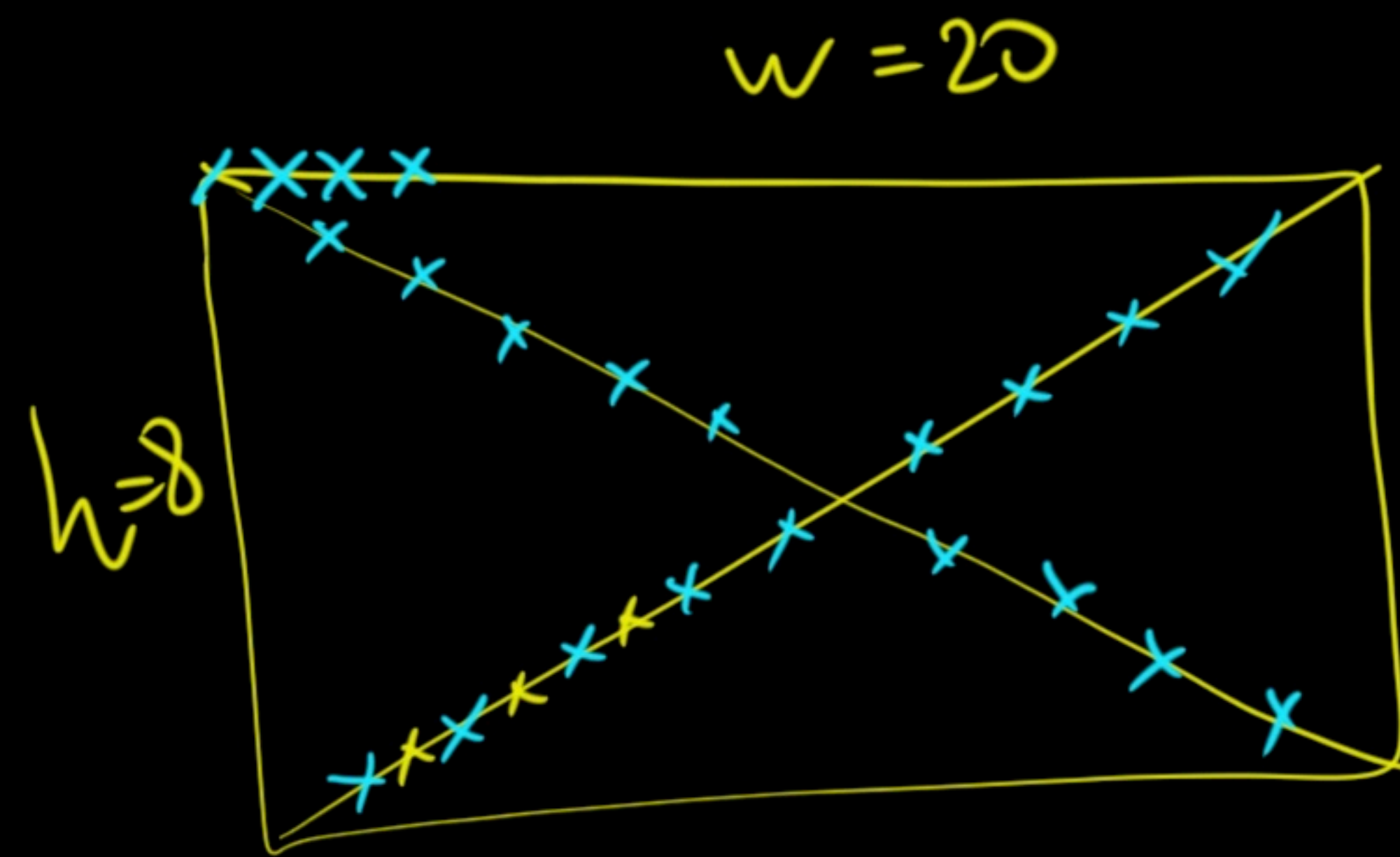
```
for (;;) {
    if (i > 15) break;
    System.out.println(i);
    i++;
}
```


1. sort r
2. binary system r
3. recursion r
4. Linked list r
5. Binary Search r
6. Hash r
7. Tree r
8. Graph : BFS, DFS r
9. Lee, A* r


```
for (int i = 0; i < 5; i++) {  
    for (char j = 'a'; j <= 'd'; j++) {  
        System.out.printf("i=%d, j=%s\n", i, j);  
    }  
}
```

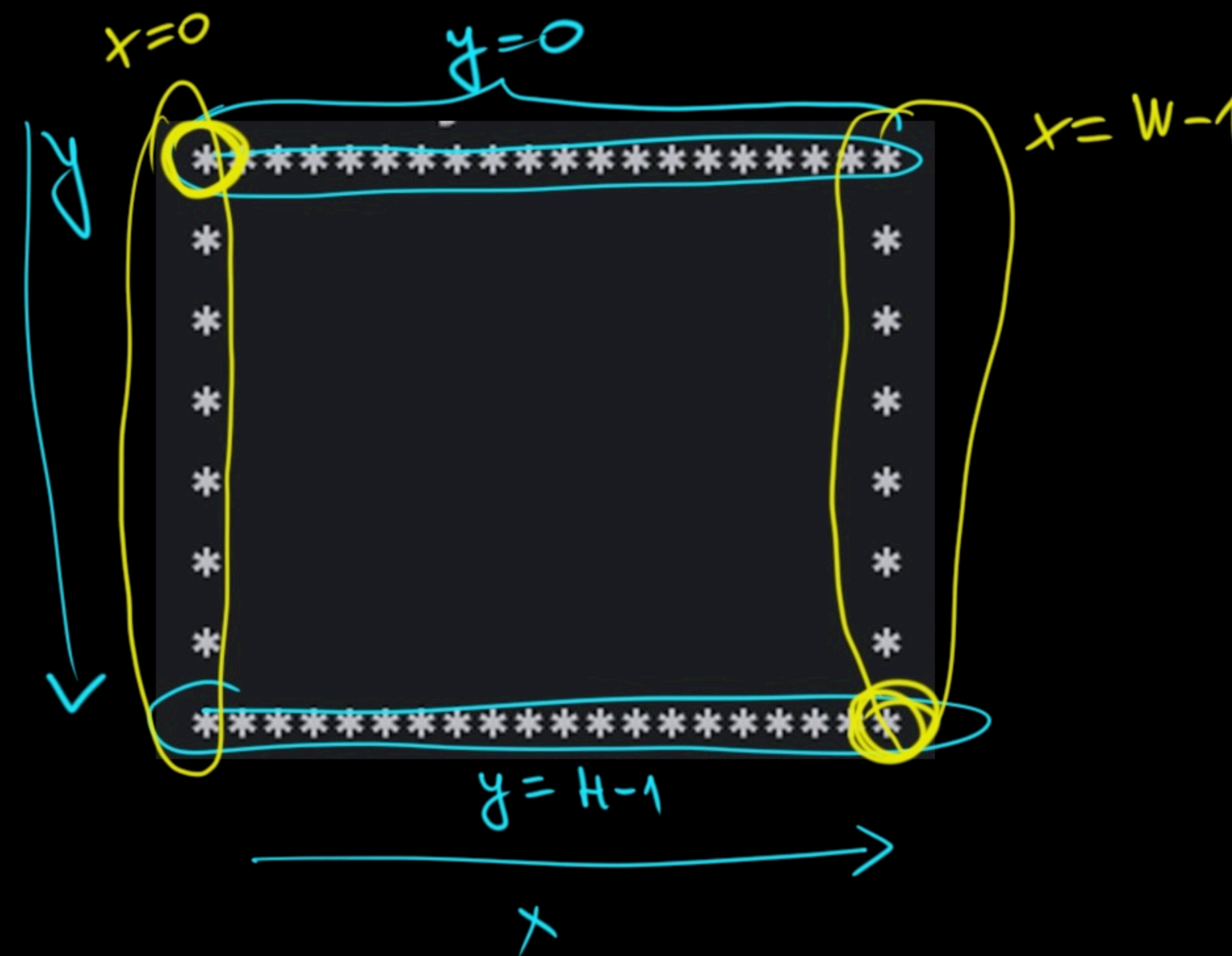
i=0, j=a
i=0, j=b
i=0, j=c
i=0, j=d
i=1, j=a
i=1, j=b
i=1, j=c
i=1, j=d
i=2, j=a
i=2, j=b
i=2, j=c
i=2, j=d
i=3, j=a
i=3, j=b
i=3, j=c
i=3, j=d
i=4, j=a
i=4, j=b
i=4, j=c
i=4, j=d





```
for (int y = 0; y < H; y++) {  
    for (int x = 0; x < W; x++) {  
  
        char c = (x == 0 || x == W - 1 ||  
                  y == 0 || y == H - 1) ? '*' : ' ';  
  
        System.out.print(c);  
    }  
    System.out.println();  
}
```

Handwritten annotations on the code: yellow circles around `x == 0`, `x == W - 1`, `y == 0`, and `y == H - 1`; yellow arrows pointing to the `?` and `'*'` in the ternary operator; a yellow box around the `' '` character.




```
double x = Math.random();
```

$[0, 1)$

$x \cdot 11$ $[0, 11)$
 $[0, 10]$

int $x = [0 \dots 10]$

$[10 \dots 100]$

$[-10 \dots 10]$

$[-100 \dots 100]$

$x \cdot 91 + 10$

$x \cdot 21 - 10$

$x \cdot 201 - 100$

$[9, 6]$

$r \cdot (b - a + 1) + a$

$[0, 1] \rightarrow [9, 6]$

$[0, 1) \rightarrow [0, 10]$
 $[0, 1) \rightarrow [0, 90]$