

# Chaining Conditionals

Getting on the chain gang



# Warmup

- What do the following code segments do?

```
int x = ...;
if(x% 2 == 0)
{
    x ++;
}
System.out.println(x);
```

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

# Warmup

- What do the following code segments do?

```
int x = ...;
if(x% 2 == 0)
{
    x ++;
}
System.out.println(x);
```

if x is odd, prints x  
if x is even, prints x+1

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

if y  $\geq$  5, increase y by 1  
if y < 5, then prints 5 forever!

# Mutual Exclusion

- Many if-cases are mutually exclusive
  - Only one of them should be true
  - When one of them is true, the others can be skipped

```
if(x == 1)
    System.out.println("A");
if(x == 2)
    System.out.println("B");
if(x == 3)
    System.out.println("C");
```

# Non-Exclusive

```
int x = ...;  
if(x >= 1)  
    System.out.print("A");  
if(x >= 2)  
    System.out.print("B");  
if(x >= 3)  
    System.out.print("C");
```

x == ...
0
1
2
3
4

# Non-Exclusive

```
int x = ...;  
if(x >= 1)  
    System.out.print("A");  
if(x >= 2)  
    System.out.print("B");  
if(x >= 3)  
    System.out.print("C");
```

x == ...	prints
0	
1	
2	
3	
4	

# Non-Exclusive

```
int x = ...;  
if(x >= 1)  
    System.out.print("A");  
if(x >= 2)  
    System.out.print("B");  
if(x >= 3)  
    System.out.print("C");
```

x == ...	prints
0	
1	
2	
3	
4	

# Non-Exclusive

```
int x = ...;  
if(x >= 1)  
    System.out.print("A");  
if(x >= 2)  
    System.out.print("B");  
if(x >= 3)  
    System.out.print("C");
```

x == ...	prints
0	
1	A
2	
3	
4	

# Non-Exclusive

```
int x = ...;  
if(x >= 1)  
    System.out.print("A");  
if(x >= 2)  
    System.out.print("B");  
if(x >= 3)  
    System.out.print("C");
```

x == ...	prints
0	
1	A
2	AB
3	
4	

# Non-Exclusive

```
int x = ...;  
if(x >= 1)  
    System.out.print("A");  
if(x >= 2)  
    System.out.print("B");  
if(x >= 3)  
    System.out.print("C");
```

x == ...	prints
0	
1	A
2	AB
3	ABC
4	

# Non-Exclusive

```
int x = ...;  
if(x >= 1)  
    System.out.print("A");  
if(x >= 2)  
    System.out.print("B");  
if(x >= 3)  
    System.out.print("C");
```

x == ...	prints
0	
1	A
2	AB
3	ABC
4	ABC

# Side Effects

```
int x = ...;  
if(x >= 1)  
    x*=-1;  
if(x < -1)  
    x+=2;  
System.out.println(x);
```

x == ...
0
1
2
3
4

# Side Effects

```
int x = ...;  
if(x >= 1)  
    x*=-1;  
if(x < -1)  
    x+=2;  
System.out.println(x);
```

x == ...	prints
0	
1	
2	
3	
4	

# Side Effects

```
int x = ...;  
if(x >= 1)  
    x*=-1;  
if(x < -1)  
    x+=2;  
System.out.println(x);
```

x == ...	prints
0	0
1	
2	
3	
4	

# Side Effects

```
int x = ...;  
if(x >= 1)  
    x*=-1;  
if(x < -1)  
    x+=2;  
System.out.println(x);
```

x == ...	prints
0	0
1	-1
2	
3	
4	

# Side Effects

```
int x = ...;  
if(x >= 1)  
    x*=-1;  
if(x < -1)  
    x+=2;  
System.out.println(x);
```

x == ...	prints
0	0
1	-1
2	0
3	
4	

# Side Effects

```
int x = ...;  
if(x >= 1)  
    x*=-1;  
if(x < -1)  
    x+=2;  
System.out.println(x);
```

x == ...	prints
0	0
1	-1
2	0
3	-1
4	

# Side Effects

```
int x = ...;  
if(x >= 1)  
    x*=-1;  
if(x < -1)  
    x+=2;  
System.out.println(x);
```

x == ...	prints
0	0
1	-1
2	0
3	-1
4	-2

# Enforcing Exclusion

- Use else-if's

```
int x = ...;  
if(x <= 1)  
    System.out.print("A");  
else if(x <= 2)  
    System.out.print("B");  
else if(x <= 3)  
    System.out.print("C");
```

x == ...
0
1
2
3
4

# Enforcing Exclusion

- Use else-if's

```
int x = ...;  
if(x <= 1)  
    System.out.print("A");  
else if(x <= 2)  
    System.out.print("B");  
else if(x <= 3)  
    System.out.print("C");
```

x == ...	prints
0	
1	
2	
3	
4	

# Enforcing Exclusion

- Use else-if's

```
int x = ...;  
if(x <= 1)  
    System.out.print("A");  
else if(x <= 2)  
    System.out.print("B");  
else if(x <= 3)  
    System.out.print("C");
```

x == ...	prints
0	A
1	
2	
3	
4	

# Enforcing Exclusion

- Use else-if's

```
int x = ...;  
if(x <= 1)  
    System.out.print("A");  
else if(x <= 2)  
    System.out.print("B");  
else if(x <= 3)  
    System.out.print("C");
```

x == ...	prints
0	A
1	A
2	
3	
4	

# Enforcing Exclusion

- Use else-if's

```
int x = ...;  
if(x <= 1)  
    System.out.print("A");  
else if(x <= 2)  
    System.out.print("B");  
else if(x <= 3)  
    System.out.print("C");
```

x == ...	prints
0	A
1	A
2	B
3	
4	

# Enforcing Exclusion

- Use else-if's

```
int x = ...;  
if(x <= 1)  
    System.out.print("A");  
else if(x <= 2)  
    System.out.print("B");  
else if(x <= 3)  
    System.out.print("C");
```

x == ...	prints
0	A
1	A
2	B
3	C
4	

# Enforcing Exclusion

- Use else-if's

```
int x = ...;  
if(x <= 1)  
    System.out.print("A");  
else if(x <= 2)  
    System.out.print("B");  
else if(x <= 3)  
    System.out.print("C");
```

x == ...	prints
0	A
1	A
2	B
3	C
4	

# Enforcing Variation

```
int x = ...;  
if(x >= 1)  
    System.out.print("A");  
else if(x >= 2)  
    System.out.print("B");  
else if(x >= 3)  
    System.out.print("C");
```

x == ...
0
1
2
3
4

# Enforcing Variation

```
int x = ...;  
if(x >= 1)  
    System.out.print("A");  
else if(x >= 2)  
    System.out.print("B");  
else if(x >= 3)  
    System.out.print("C");
```

x == ...	prints
0	
1	
2	
3	
4	

# Enforcing Variation

```
int x = ...;  
if(x >= 1)  
    System.out.print("A");  
else if(x >= 2)  
    System.out.print("B");  
else if(x >= 3)  
    System.out.print("C");
```

x == ...	prints
0	
1	
2	
3	
4	

# Enforcing Variation

```
int x = ...;  
if(x >= 1)  
    System.out.print("A");  
else if(x >= 2)  
    System.out.print("B");  
else if(x >= 3)  
    System.out.print("C");
```

x == ...	prints
0	
1	A
2	
3	
4	

# Enforcing Variation

```
int x = ...;
if(x >= 1)
    System.out.print("A");
else if(x >= 2)
    System.out.print("B");
else if(x >= 3)
    System.out.print("C");
```

x == ...	prints
0	
1	A
2	A
3	
4	

# Enforcing Variation

```
int x = ...;  
if(x >= 1)  
    System.out.print("A");  
else if(x >= 2)  
    System.out.print("B");  
else if(x >= 3)  
    System.out.print("C");
```

x == ...	prints
0	
1	A
2	A
3	A
4	

# Enforcing Variation

```
int x = ...;  
if(x >= 1)  
    System.out.print("A");  
else if(x >= 2)  
    System.out.print("B");  
else if(x >= 3)  
    System.out.print("C");
```

x == ...	prints
0	
1	A
2	A
3	A
4	A

# No More Side Effects!

```
int x = ...;  
if(x >= 1)  
    x*=-1;  
else if(x < 1)  
    x+=2;  
System.out.println(x);
```

x == ...
0
1
2
3
4

# No More Side Effects!

```
int x = ...;  
if(x >= 1)  
    x*=-1;  
else if(x < 1)  
    x+=2;  
System.out.println(x);
```

x == ...	prints
0	
1	
2	
3	
4	

# No More Side Effects!

```
int x = ...;  
if(x >= 1)  
    x*=-1;  
else if(x < 1)  
    x+=2;  
System.out.println(x);
```

x == ...	prints
0	2
1	
2	
3	
4	

# No More Side Effects!

```
int x = ...;  
if(x >= 1)  
    x*=-1;  
else if(x < 1)  
    x+=2;  
System.out.println(x);
```

x == ...	prints
0	2
1	-1
2	
3	
4	

# No More Side Effects!

```
int x = ...;  
if(x >= 1)  
    x*=-1;  
else if(x < 1)  
    x+=2;  
System.out.println(x);
```

x == ...	prints
0	2
1	-1
2	-2
3	
4	

# No More Side Effects!

```
int x = ...;  
if(x >= 1)  
    x*=-1;  
else if(x < 1)  
    x+=2;  
System.out.println(x);
```

x == ...	prints
0	2
1	-1
2	-2
3	-3
4	

# No More Side Effects!

```
int x = ...;  
if(x >= 1)  
    x*=-1;  
else if(x < 1)  
    x+=2;  
System.out.println(x);
```

x == ...	prints
0	2
1	-1
2	-2
3	-3
4	-4

# Catch All Case

- What if we want a case that says if none of the other cases are “hit,” then this final case is executed?
- For this, we use an **else** case

```
int x = ...;  
if(x % 2 == 0)  
    System.out.println(“even”);  
else  
    System.out.println(“odd”);
```

# More Else

```
int die = (int)(Math.random()*6)+1;
if(die % 2 == 0)
    System.out.println("even");
else if(die == 1)
    System.out.println("1");
else if(die == 3)
    System.out.println("3");
else
    System.out.println("5");
```

# Clever Chaining for two alternatives

```
if(x >= 0 && y >= 0)
    System.out.println("Both non-negative");
else if (x >= 0)
    System.out.println("x non-negative");
else if (y >= 0)
    System.out.println("y non-negative");
else
    System.out.println("both negative");
```

# Bad Chaining

```
if (x >= 0)
    System.out.println("x non-negative");
else if (y >= 0)
    System.out.println("y non-negative");
else if(x >= 0 && y >= 0)
    System.out.println("Both non-negative");
else
    System.out.println("both negative");
```

x	y
0	0
-1	0
0	-1

# Bad Chaining

```
if (x >= 0)
    System.out.println("x non-negative");
else if (y >= 0)
    System.out.println("y non-negative");
else if(x >= 0 && y >= 0)
    System.out.println("Both non-negative");
else
    System.out.println("both negative");
```

x	y	prints
0	0	
-1	0	
0	-1	

# Bad Chaining

```
if (x >= 0)
    System.out.println("x non-negative");
else if (y >= 0)
    System.out.println("y non-negative");
else if(x >= 0 && y >= 0)
    System.out.println("Both non-negative");
else
    System.out.println("both negative");
```

x	y	prints
0	0	x non-negative
-1	0	
0	-1	

# Bad Chaining

```
if (x >= 0)
    System.out.println("x non-negative");
else if (y >= 0)
    System.out.println("y non-negative");
else if(x >= 0 && y >= 0)
    System.out.println("Both non-negative");
else
    System.out.println("both negative");
```

x	y	prints
0	0	x non-negative
-1	0	y non-negative
0	-1	

# Bad Chaining

```
if (x >= 0)
    System.out.println("x non-negative");
else if (y >= 0)
    System.out.println("y non-negative");
else if(x >= 0 && y >= 0)
    System.out.println("Both non-negative");
else
    System.out.println("both negative");
```

x	y	prints
0	0	x non-negative
-1	0	y non-negative
0	-1	x non-negative

# Connected Chains

```
int x = ...;  
if(x % 2 == 0)  
    System.out.print("A");  
if(x > 4)  
    System.out.print("B");  
else  
    System.out.print("C");
```

x == ...	prints
2	
3	
4	
5	
6	

# Connected Chains

```
int x = ...;  
if(x % 2 == 0)  
    System.out.print("A");  
if(x > 4)  
    System.out.print("B");  
else  
    System.out.print("C");
```

x == ...
2
3
4
5
6

# Connected Chains

```
int x = ...;  
if(x % 2 == 0)  
    System.out.print("A");  
if(x > 4)  
    System.out.print("B");  
else  
    System.out.print("C");
```

x == ...	prints
2	
3	
4	
5	
6	

# Connected Chains

```
int x = ...;
if(x % 2 == 0)
    System.out.print("A");
if(x > 4)
    System.out.print("B");
else
    System.out.print("C");
```

x == ...	prints
2	AC
3	
4	
5	
6	

# Connected Chains

```
int x = ...;
if(x % 2 == 0)
    System.out.print("A");
if(x > 4)
    System.out.print("B");
else
    System.out.print("C");
```

x == ...	prints
2	AC
3	C
4	
5	
6	

# Connected Chains

```
int x = ...;
if(x % 2 == 0)
    System.out.print("A");
if(x > 4)
    System.out.print("B");
else
    System.out.print("C");
```

x == ...	prints
2	AC
3	C
4	AC
5	
6	

# Connected Chains

```
int x = ...;
if(x % 2 == 0)
    System.out.print("A");
if(x > 4)
    System.out.print("B");
else
    System.out.print("C");
```

x == ...	prints
2	AC
3	C
4	AC
5	B
6	

# Connected Chains

```
int x = ...;
if(x % 2 == 0)
    System.out.print("A");
if(x > 4)
    System.out.print("B");
else
    System.out.print("C");
```

x == ...	prints
2	AC
3	C
4	AC
5	B
6	AB