Rekursjon

UKE 12 - GRUPPE 3

MIAU@IFI.UIO.NO

Plan for dagen

- Hva er rekursjon?
- Call stack
- Rekursjon i lenkede lister

Hva er rekursjon?

- En rekursiv metode er en metode som kaller på seg selv

- *Basistilfelle*
  - Noe som må oppnås før metoden kan slutte å kalle på seg selv
- *Rekursjonssteget*
  - Kaller på metoden igjen, gjerne med noen endringer

- Kan minne om en while-løkke → noe gjøres helt til basistilfellet er nådd
- Alt som kan gjøres iterativt, kan gjøres rekursivt

```java
public class IterasjonsEksempel {

    Run | Debug
    public static void main(String[] args) {
        tellNed(n: 5);
    }

    public static void tellNed(int n) {
        while (n >= 0) {
            System.out.println(n);
            n--;
        }
    }
}
```

```
5
4
3
2
1
```

```java
class RekursjonsEksempel {

    Run | Debug
    public static void main(String[] args) {
        tellNed(n: 5);
    }

    public static void tellNed(int n) {

        // basissteget:
        if (n <= 0) {
            return;
        }

        // rekursjonssteget:
        System.out.println(n);
        tellNed(n - 1);
    }
}
```

```
5
4
3
2
1
```

Call stack

- Når man kaller på en metode, legges kallet på en *call stack*
  - Stack (stabel) → Siste som legges til, er det første som fjernes
- En rekursiv metode vil legge kallene sine på call stacken
- Når basistilfellet nås, vil vi bevege oss nedover i stacken (kallene poppes)
  - Det siste kallet poppes først
  - Det første kallet poppes sist

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

    }

    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```



Stack

Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

    }

    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```



tellOppover(5)

Stack

Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

    }

    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```



tellOppover(5)

Stack

Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

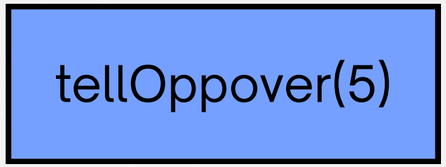
    }

    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack

Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

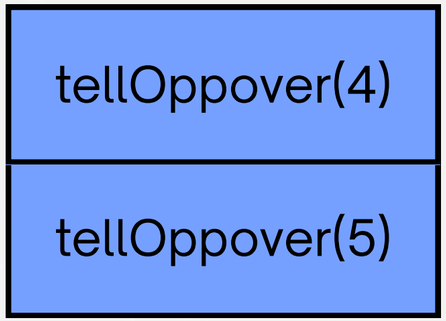
    }

    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack

Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

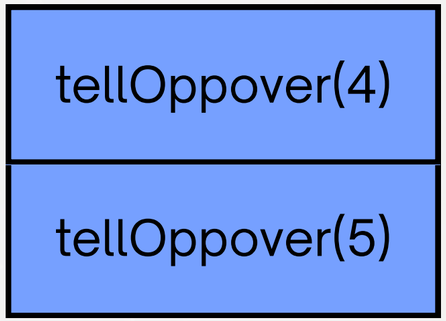
    }

    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack

Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

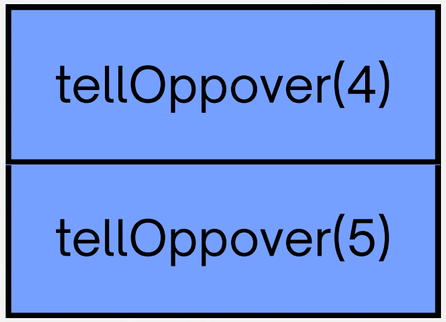
    }

    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack

Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

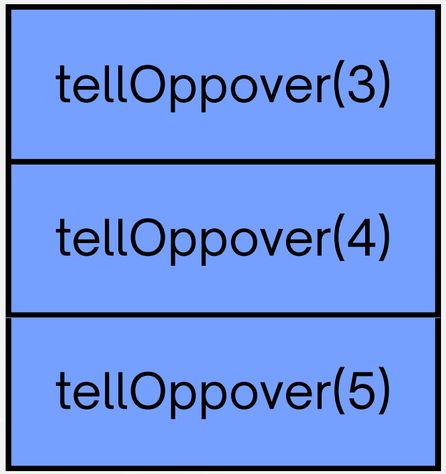
    }

    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack

Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

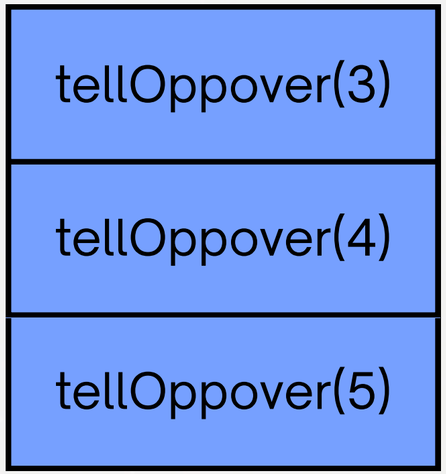
    }

    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack

Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

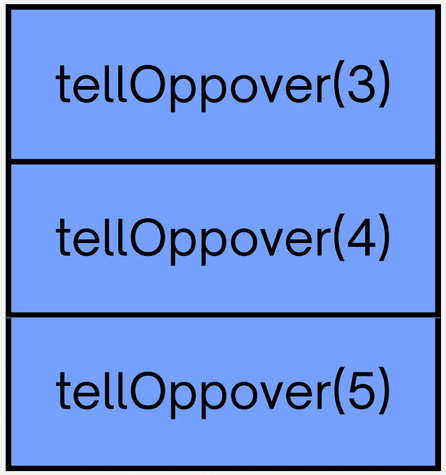
    }

    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack

Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

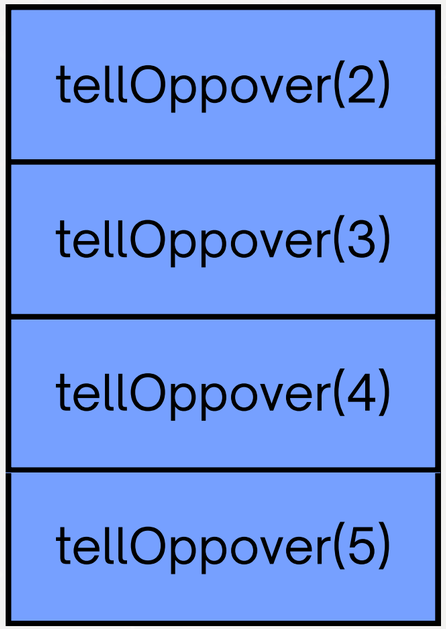
    }

    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack

Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

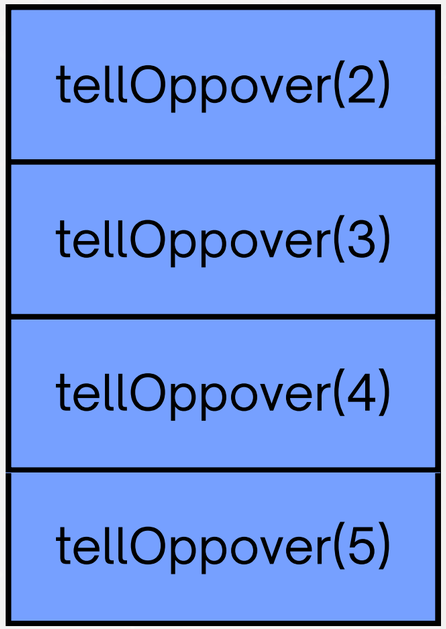
    }

    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack

Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

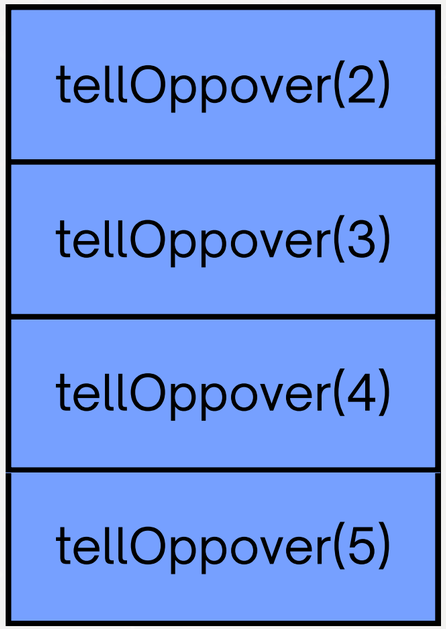
    }

    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack

Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

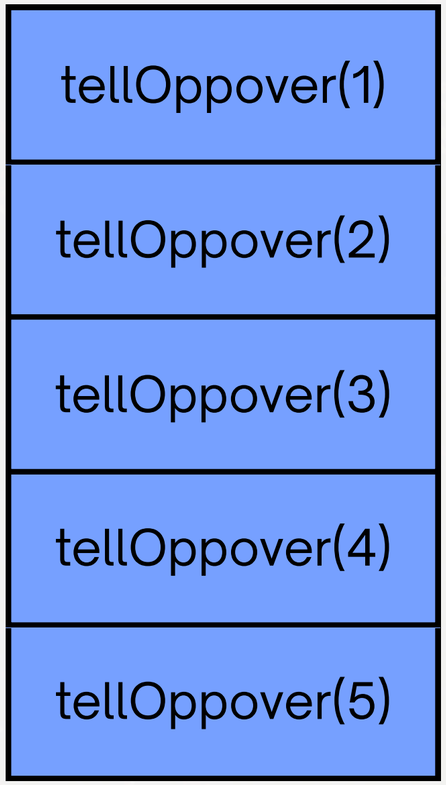
    }

    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack

Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

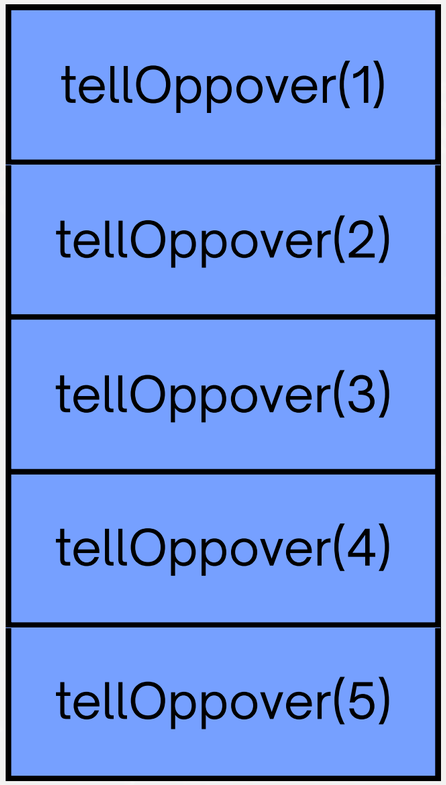
    }

    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack

Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

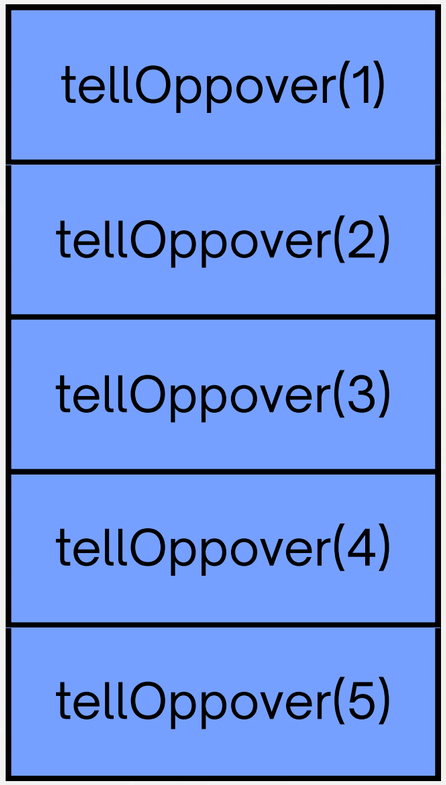
    }

    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack

Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

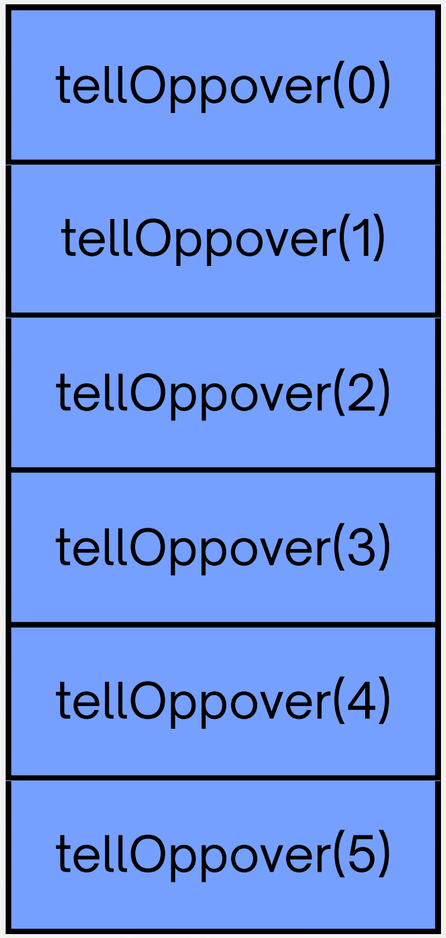
    }

    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack

Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

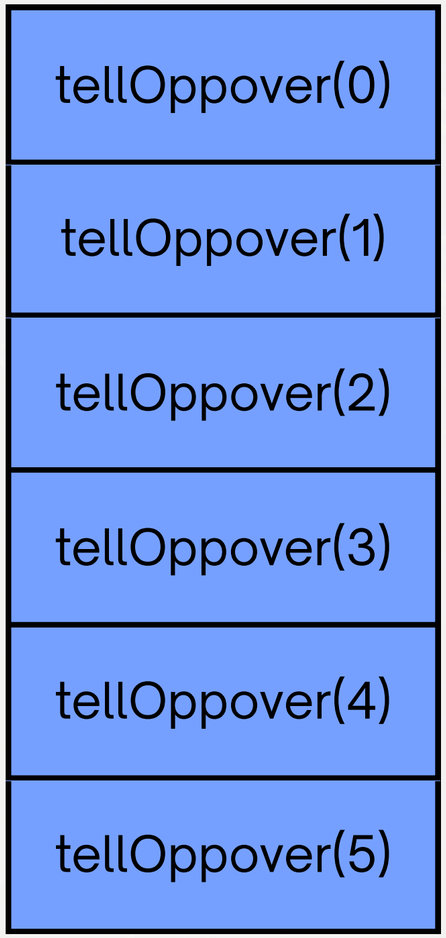
    }

    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack

Output

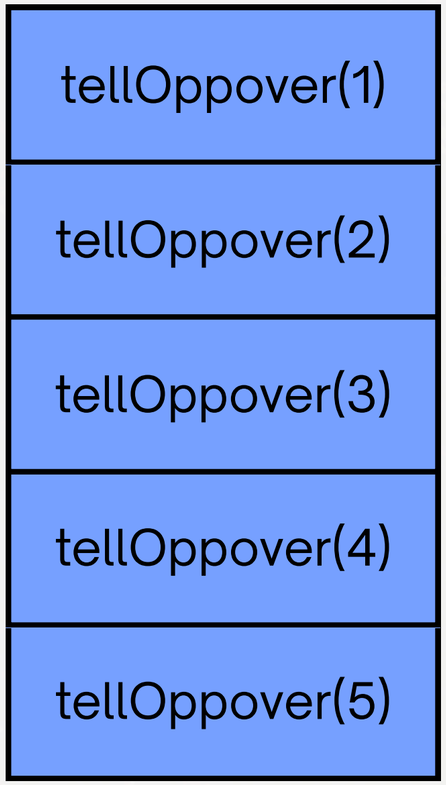
```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

    }

    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```



Stack

Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

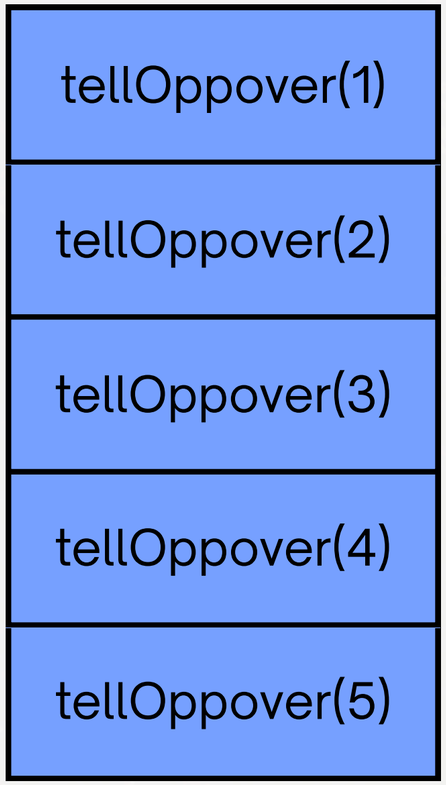
    }

    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack

Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

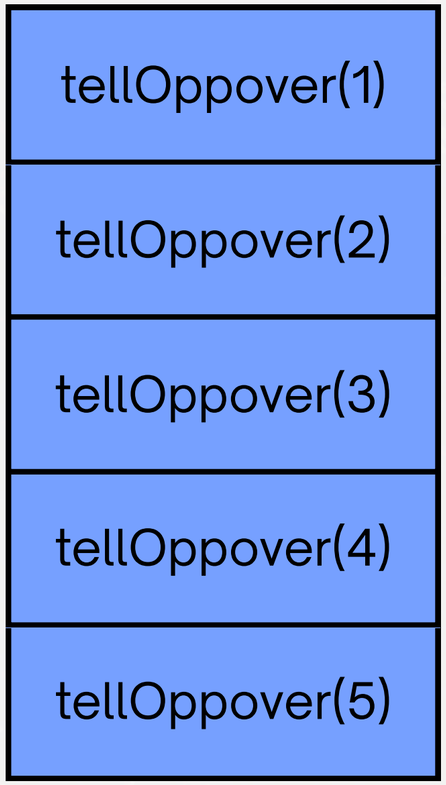
    }

    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack

Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

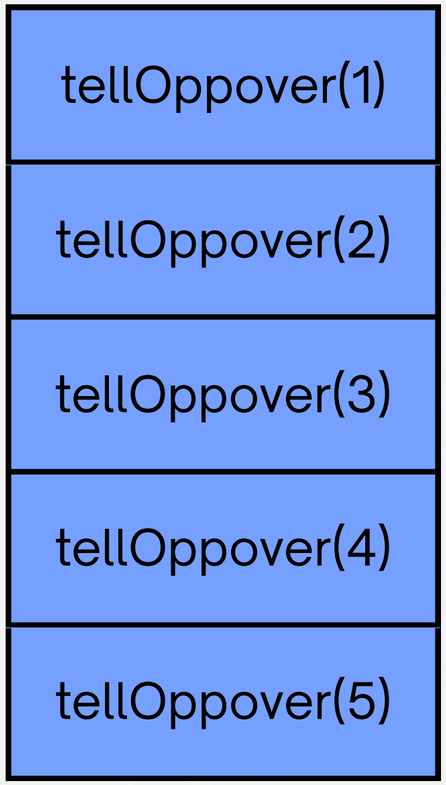
    }

    public static void tellOppover(int n) {

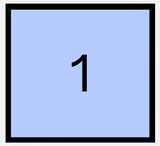
        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack



Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

    }

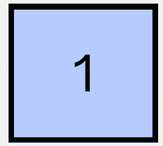
    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```



Stack



Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

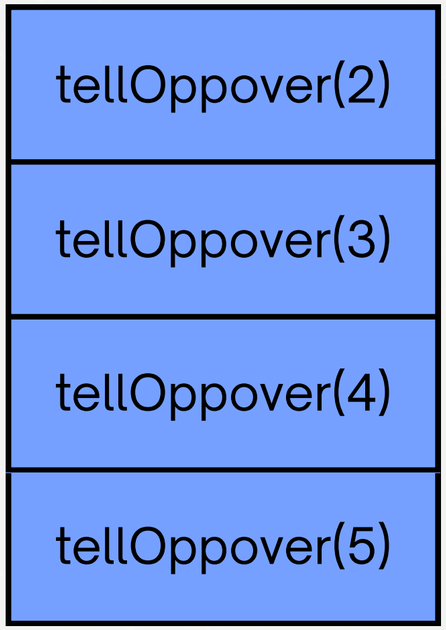
    }

    public static void tellOppover(int n) {

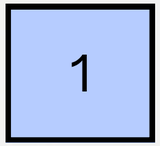
        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack



Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

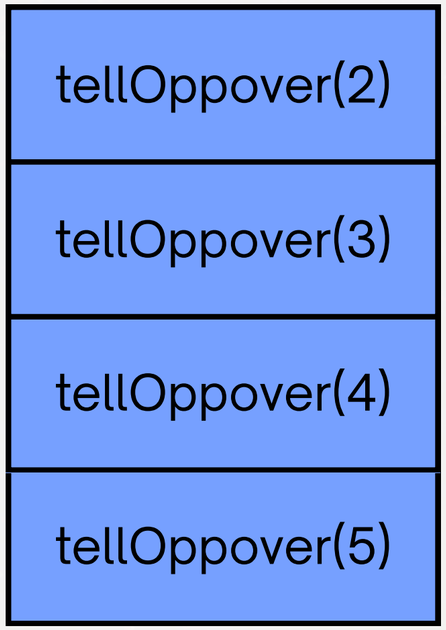
    }

    public static void tellOppover(int n) {

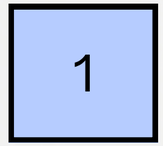
        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack



Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

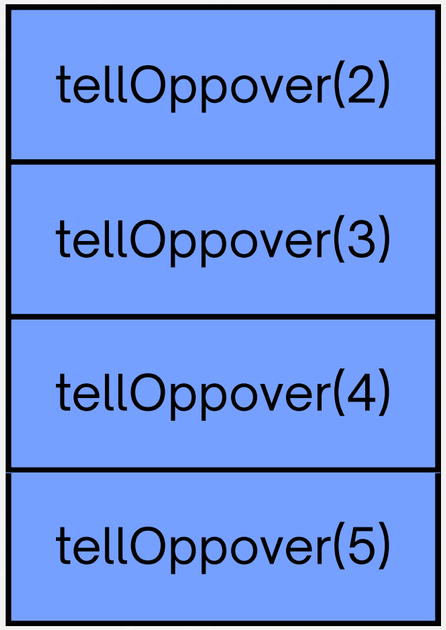
    }

    public static void tellOppover(int n) {

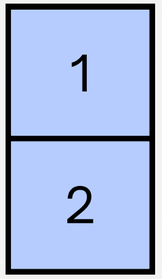
        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack



Output

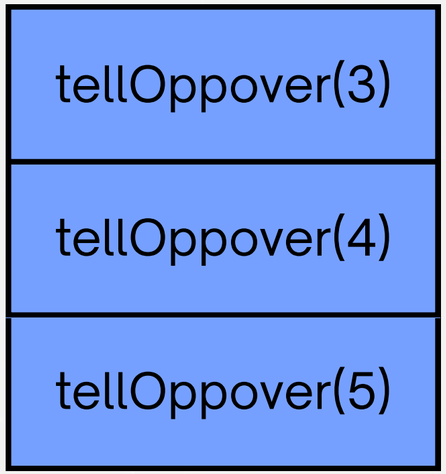
```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

    }

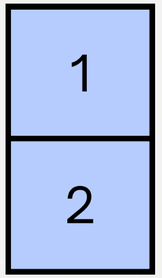
    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```



Stack



Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

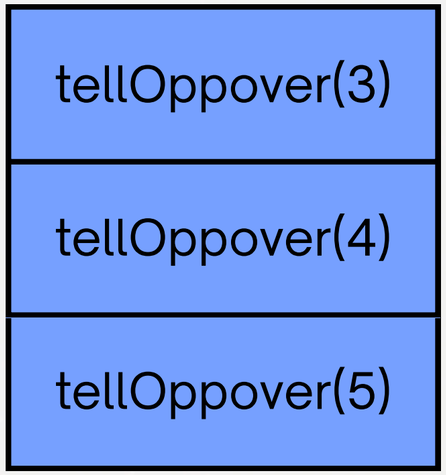
    }

    public static void tellOppover(int n) {

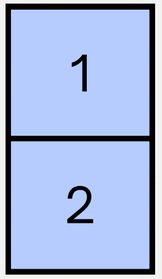
        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack



Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

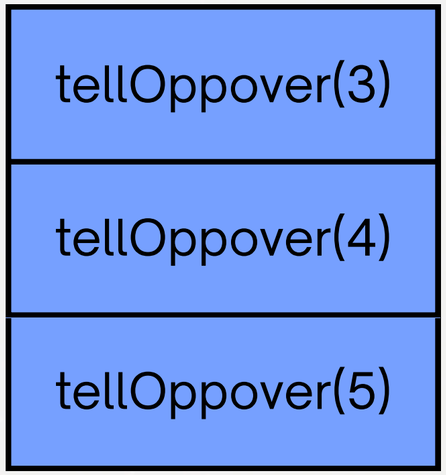
    }

    public static void tellOppover(int n) {

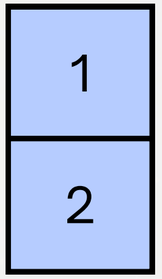
        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack



Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

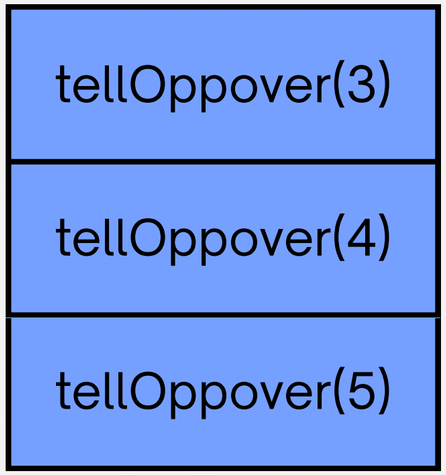
    }

    public static void tellOppover(int n) {

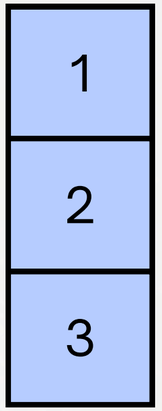
        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack



Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

    }

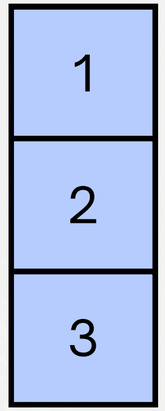
    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```



Stack



Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

    }

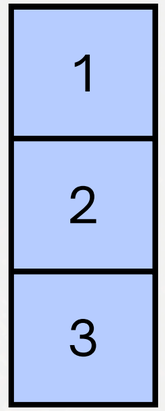
    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```



Stack



Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

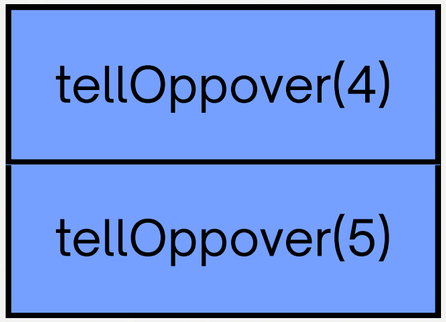
    }

    public static void tellOppover(int n) {

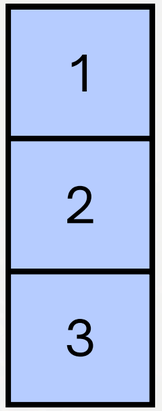
        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack



Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

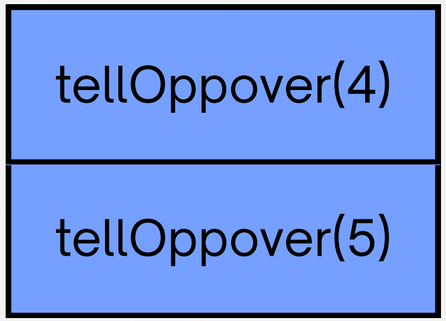
    }

    public static void tellOppover(int n) {

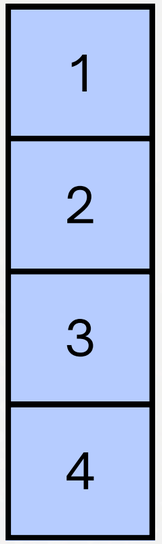
        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack



Output

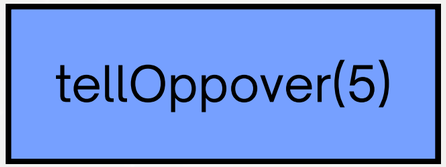
```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

    }

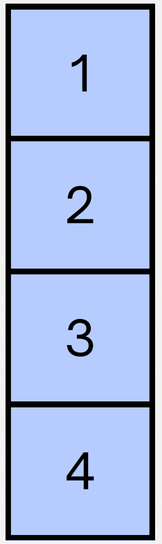
    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```



Stack



Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

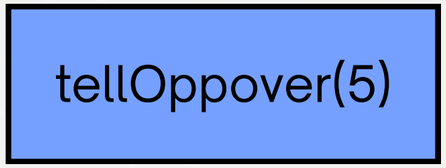
    }

    public static void tellOppover(int n) {

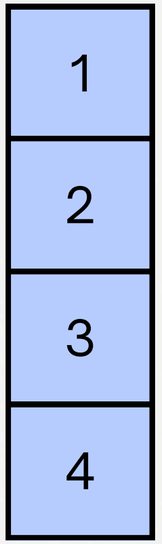
        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack



Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

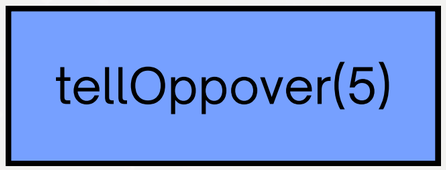
    }

    public static void tellOppover(int n) {

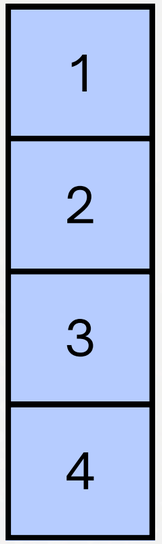
        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack



Output

```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

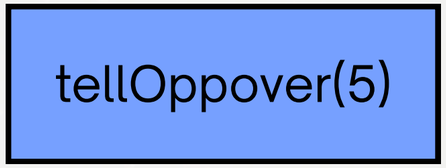
    }

    public static void tellOppover(int n) {

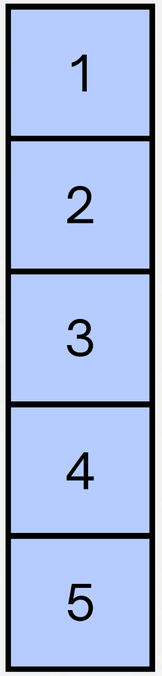
        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```





Stack



Output

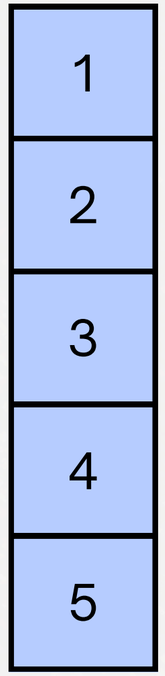
```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

    }

    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```



Stack

Output

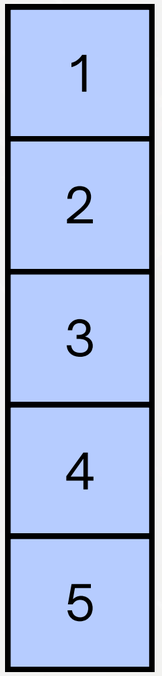
```java
class TellOppover {
    Run | Debug
    public static void main(String[] args) {
        tellOppover(n: 5);

    }

    public static void tellOppover(int n) {

        if (n <= 0) {
            return;
        }

        tellOppover(n - 1);
        System.out.println(n);
    }
}
```



Output

Rekursjon i lenkede lister

```java
public int finnEldste(Katt katt) {

    // basissteget:
    if (katt.neste == null) {
        return katt.alder;
    }

    // rekursjonssteget:
    int eldste = finnEldste(katt.neste);

    if (katt.alder > eldste) {
        return katt.alder;
    } else {
        return eldste;
    }
}
```