

Today

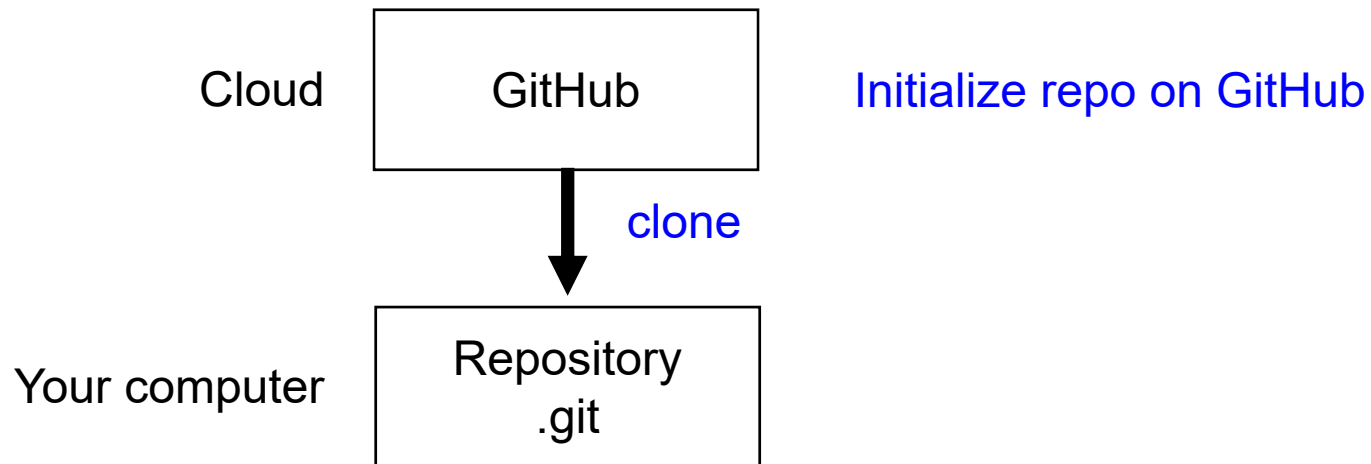
- HW recap & questions
 - Git & GitHub
 - Programming: selection structures
- Programming: repetition structures

Git & GitHub

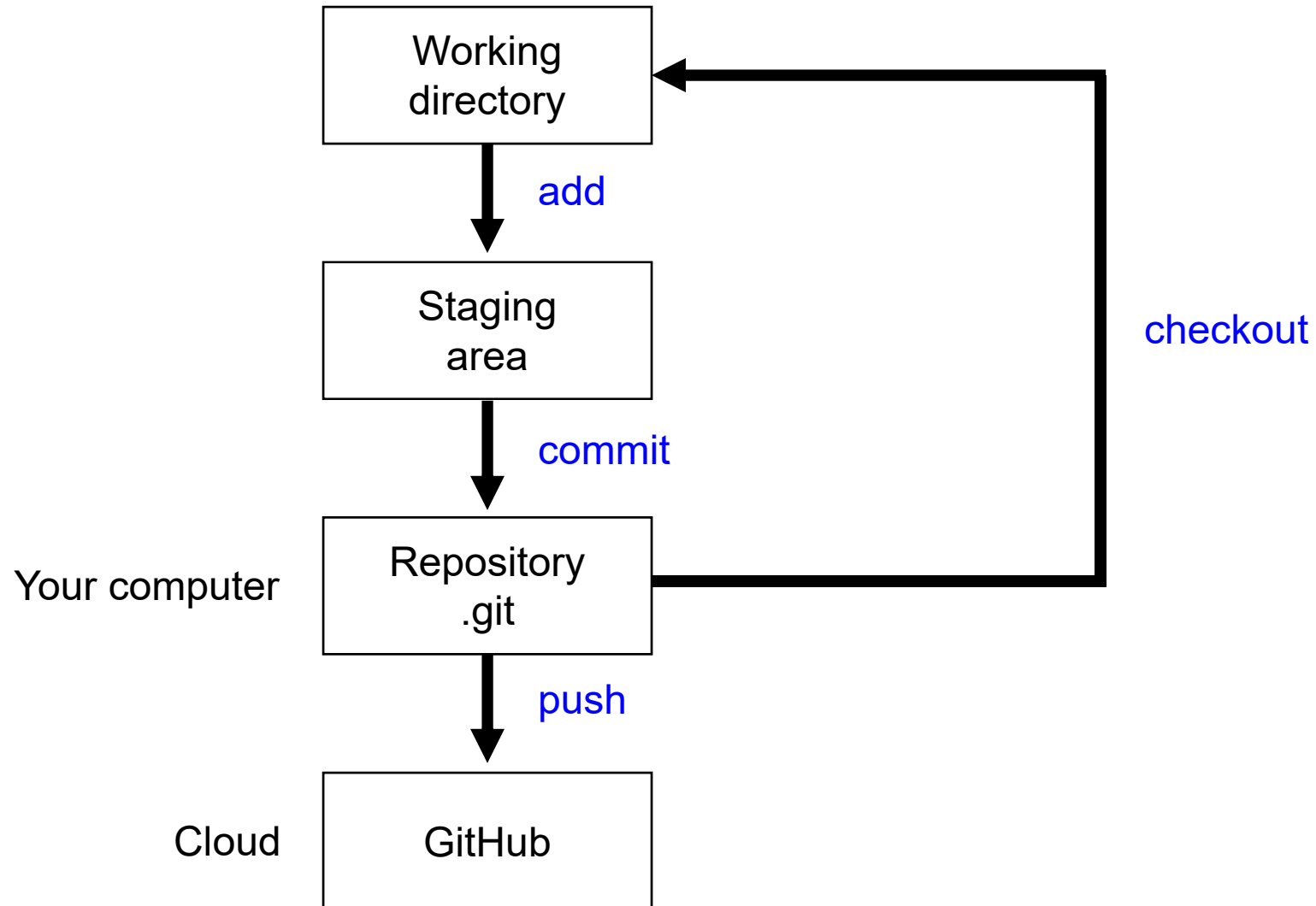
- Git
 - version control software
- GitHub
 - cloud service for storing and collaborating on git repositories

Initialize a Git repo

Github first workflow



Version control workflow



R's selection structures

if	single selection structure
if/else	double selection structure
if/else if	multiple selection structure

Questions?

Structured programming

- Sequence structure
 - order to perform actions
- Selection structure (conditional, branches)
 - what to do depending on a decision
- Repetition structure (iteration, loops)
 - do something many times

?Control #for help in R

Structured programming

- Sequence structure
 - order to perform actions
- Selection structure (conditional, branches)
 - what to do depending on a decision
- Repetition structure (iteration, loops)
 - do something many times

?Control #for help in R

R's repetition structures

- **while**

```
while ( condition ) {  
    expression  
}
```

general

- **for**

```
for ( var in seq ) {  
    expression  
}
```

specialized

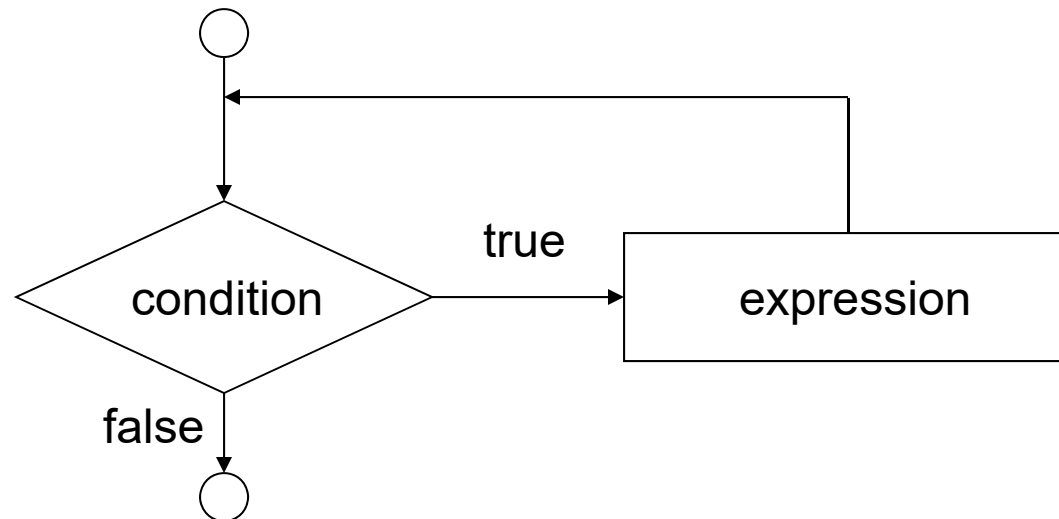
Repetition structures

- Two main types:
- Sentinel controlled repetition
 - number of reps is unknown from the start
 - recognize when the task is finished by testing a condition
- Counter controlled repetition
 - number of reps is known from the start (e.g. repeat 1000 times)

while repetition structure

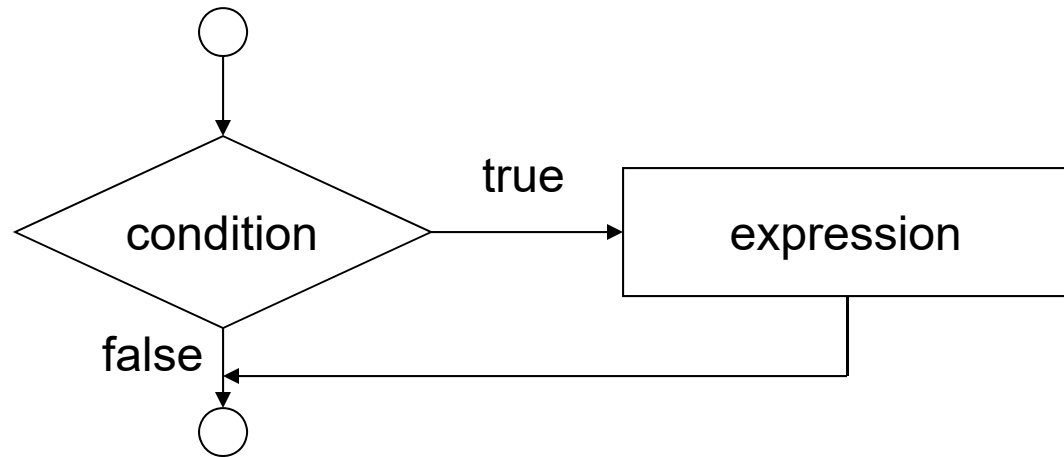
```
while ( condition ) {  
    expression1  
    expression2  
    ...  
}
```

Good programming practice:
brace, space, indent

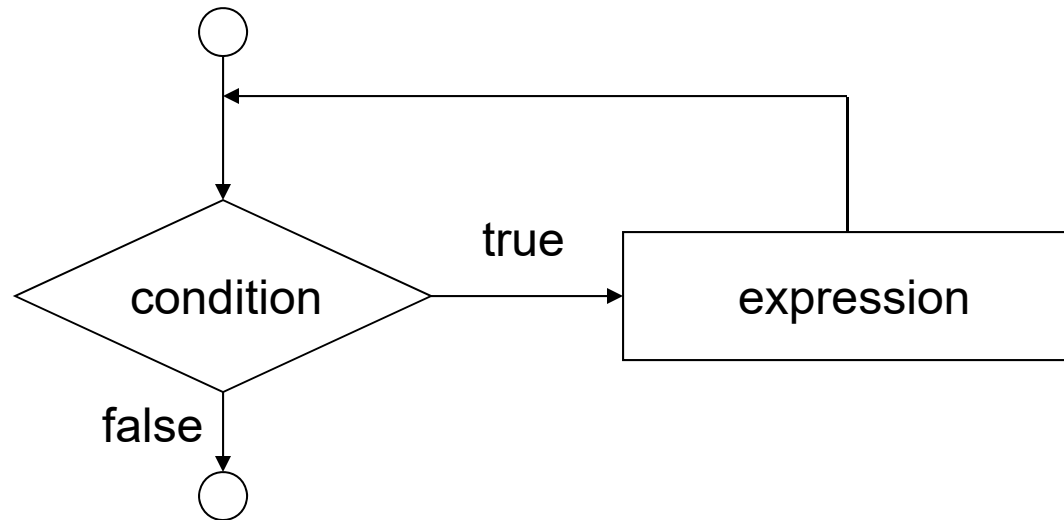


if and while are fundamental

if



while

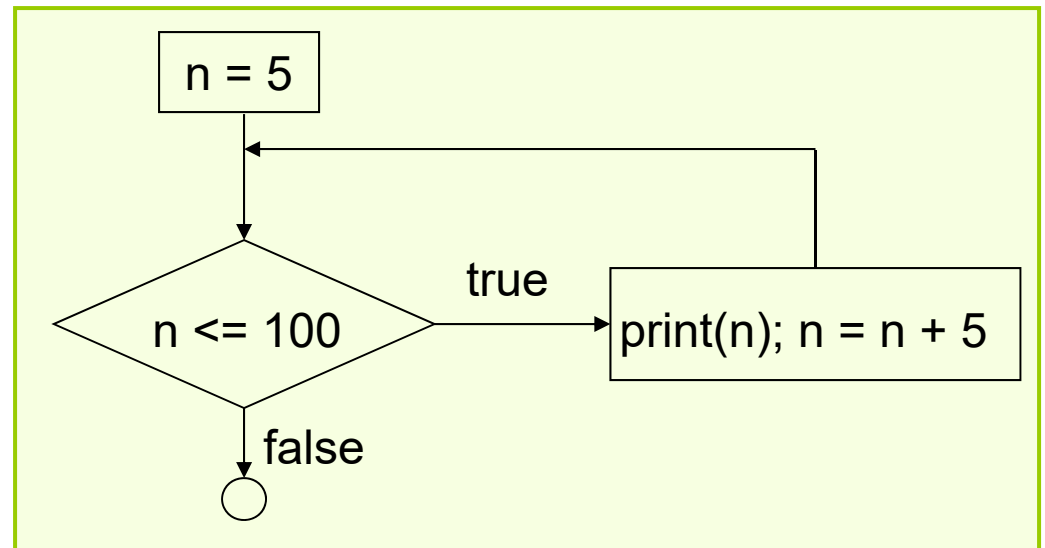


Both sentinel-controlled and counter-controlled repetition can be done with **while**

while repetition structure

- Sentinel controlled repetition
- e.g. print every fifth integer up to 100

```
n <- 5
while ( n <= 100 ) {
  print(n)
  n <- n + 5
}
```



Algorithms

Often have three phases:

1) **Initialization** phase

e.g. setting up vectors, matrices, initial values

2) **Processing** phase

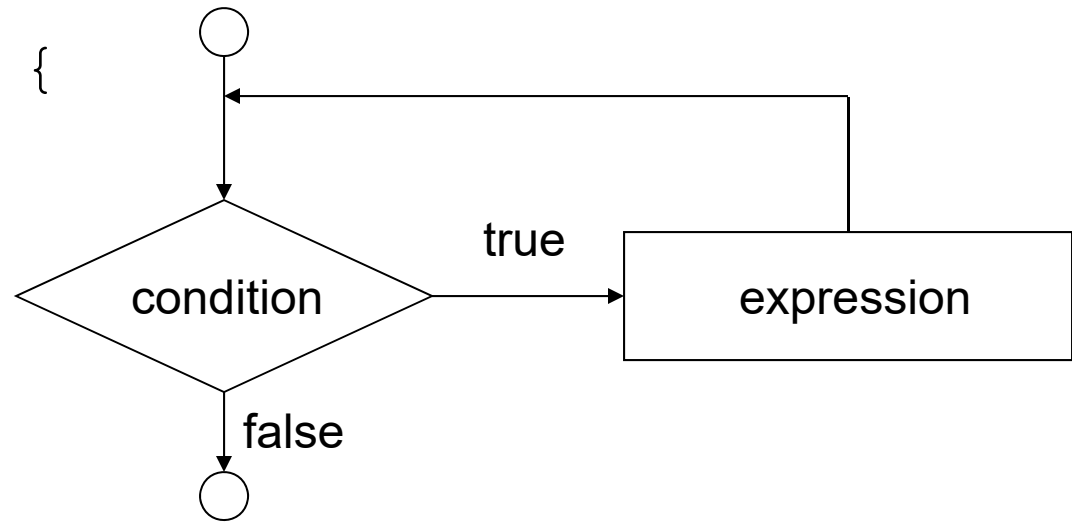
e.g. calculations, manipulations

3) **Termination** phase

e.g. printing or graphing the result

Exercise: while, sentinel control

```
while (condition) {  
    expression1  
    expression2  
    ...  
}
```



Exercise: sentinel controlled repetition

Using the `while` structure, find the first number greater than 1000 that is a power of 2, and print the result. You can't use the `"^"` operator.

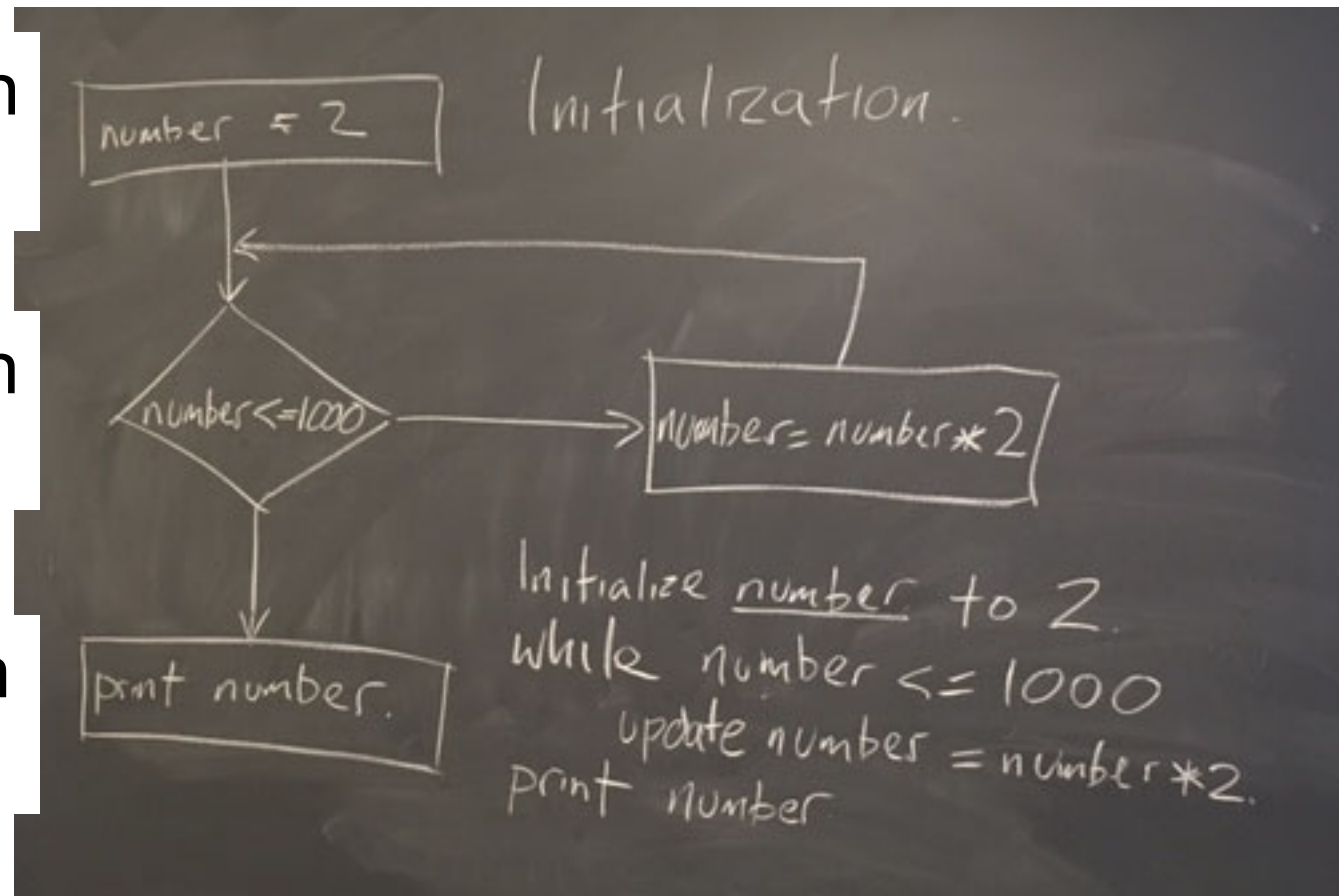
Hint: start by initializing `number <- 2` and then repeatedly multiply by 2. The first four powers of 2 are 2, 4, 8, 16.

Flowchart and pseudocode first!!

Initialization
phase

Calculation
phase

Termination
phase



while repetition structure

- Counter controlled repetition

```
i <- 1 #initialize the counter
while ( i <= n ) {
    expression
    i <- i + 1
}
```

Exercise: counter controlled repetition

Using the `while` structure, write a program where you can enter any real number x and positive integer z and the program will calculate $y = x^z$. BUT you cannot use the `"^"` operator. Check your result using R's native exponentiation. **Flowchart and pseudocode first!!**

Initialization
phase

Calculation
phase

Termination
phase

