Introduktion til C

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SDU

24. februar 2018

Plan for i dag

Del 1 (klokken 10.15-12.00)

- Oversættelse og afvikling af et program
- Variable, datatyper og aritmetiske udtryk
- Forgreninger
- Løkker
- Arrays

Del 2 (klokken 12.45-14.00)

- Funktioner
- Strukturer
- Pointers
- Input og output

Kodecafe (klokken 14.15-16.00)

Del 1

Oversættelse og afvikling af et program

```c
#include <stdio.h>

int main() {
    printf("Hello world!\n");
    return 0;
}
```

```
$ gcc program.c

$ ./a.out
# ↪ Hello world!
```

Oversættelse og afvikling af et program

```c
#include <stdio.h>

int main() {
    printf("Hello world!\n");
    return 0;
}
```

```
$ gcc program.c -o program

$ ./program
# ↪ Hello world!
```

Oversættelse og afvikling af et program

```c
#include <stdlib.h>
#include <stdio.h>
#include <stdbool.h>

int main(int argc, char** argv) {
    ... // <- Focus
    return 0;
}
```

Forskelle på C og Java

```java
public class Hello {
    public static void main(String args[]) {
        System.out.println("Hello world!");
    }
}
```

```c
#include <stdio.h>
int main(int argc, char** argv) {
    printf("Hello world!\n");
    return 0;
}
```

Forskelle på C og Java

```java
public class FizzBuzz {
    public static void main(String args[]) {
        int lower = 1;
        int upper = 100;
        for (int i = lower; i < upper; i++) {
            if (i % 3 == 0 || i % 5 == 0) {
                System.out.println(" " + i);
            }
        }
    }
}
```

```c
#include <stdio.h>
int main(int argc, char** argv) {
    int lower = 1;
    int upper = 100;
    for (int i = lower; i < upper; i++) {
        if (i % 3 == 0 || i % 5 == 0) {
            printf(" %d\n", i);
        }
    }
    return 0;
}
```

Variable, datatyper og aritmetiske udtryk

```
int n;
n = 5;
```

Variable, datatyper og aritmetiske udtryk

```
int n;
n = 5;
```

```
int n = 5;
```

Variable, datatyper og aritmetiske udtryk

```
int n;
n = 5;
```

```
int n = 5;
```

Værdien af `n` inden `n = 5`?

Variable, datatyper og aritmetiske udtryk

Typer

`int`, `long`,
`char`,
`bool`,
`float`, `double`,
`size_t`, `...`

Variable, datatyper og aritmetiske udtryk

```
int a = 18;
int b = 24;
int c = a + b;
```

Variable, datatyper og aritmetiske udtryk

```
int a = 18;
int b = 24;
int c = a + b;
```

```
bool p = true;
bool q = false;
bool r = p && q;
```

Variable, datatyper og aritmetiske udtryk

```
int a = 18;
int b = 24;
int c = a + b;
```

```
bool p = true;
bool q = false;
bool r = p && q;
```

```
+, -, *, /, %
&&, ||
==, !=
```

Forgreninger

```
int a = 13;
if (a > 10) {
    printf("Success!\n");
}
```

Forgreninger

```
int a = 13;
bool b = true;
if (a < 20 && !b) {
    printf("Success!\n");
} else {
    printf("Fail!\n");
}
```

Løkker

```
int a = 5;
int l = 0;
while (a > 1) {
    printf("%d\n", a);
    a = a / 2;
    l++;
}
printf("%d\n", l);
```

Løkker

```
int a = -5;
do {
    printf("%d\n", a);
    a = a / 2;
} while (a > 1);
printf("%d\n", a);
```

Løkker

```
for (int i = 0; i < 20; i++) {
    printf("%d\n", i);
}
```

Arrays

```
int arr[10];
```

Arrays

```
int arr[10];

arr[0] = 17;
arr[1] = 25;
arr[9] = arr[0] + arr[1];
```

Arrays

```
int arr[10];

arr[0] = 17;
arr[1] = 25;
arr[9] = arr[0] + arr[1];

int b[] = {1, 2, 3};
```

Arrays

Strings

```
char c[] = {'a', 'b', 'c', '\0'};
```

Arrays

Strings

```
char c[] = "abc";
```

printf

```
printf("Her er du:\n");
printf("By:       %s\n",    "Odense");
printf("Post nr.: %d\n",    5000);
printf("Grader:   %f °C\n", 17.3);
```

printf

```
printf("Her er du:\n");
printf("By:       %s\n",    "Odense");
printf("Post nr.: %d\n",    5000);
printf("Grader:   %f °C\n", 17.3);
```

```
printf("Grader:    %.1f °C\n", 17.3);
printf("Procent:   %03d %%\n", 31);
```

Opgaver

Vi mødes her igen kl. 12:45

Del 2

Funktioner

```
type func_name(type1 arg1, type2 arg2, ...) {
    ...
    return ...;
}
```

Funktioner

```
type func_name(type1 arg1, type2 arg2, ...) {
    ...
    return ...;
}
```

```
int add_one(int x) {
    return x+1;
}
```

Funktioner

```c
int main() {
    printf("Hello world!\n");
    return 0;
}
```

Funktioner

```c
int main() {
    printf("Hello world!\n");
    return 0;
}
```

```c
void print_hej(void) {
    printf("Hej!\n");
}
```

Funktioner

```
int main() {
    int y = add_one(41);

    return 0;
}

int add_one(int x) {
    return x+1;
}
```

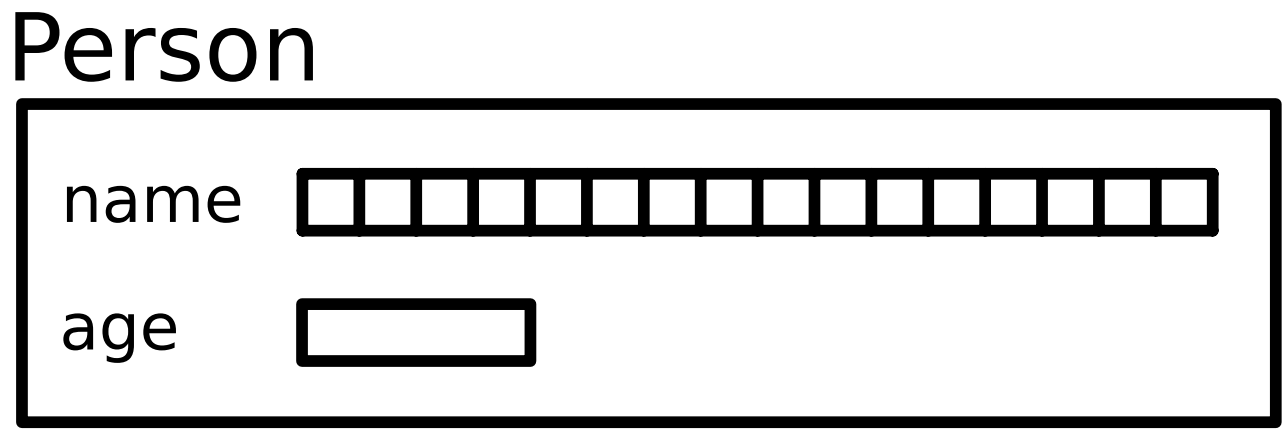
Funktioner

```c
int add_one(int x);

int main() {
    int y = add_one(41);

    return 0;
}

int add_one(int x) {
    return x+1;
}
```

Strukturer ("Structs")

```
struct Person {
    char name[16];
    int  age;
};
```

Strukturer ("Structs")



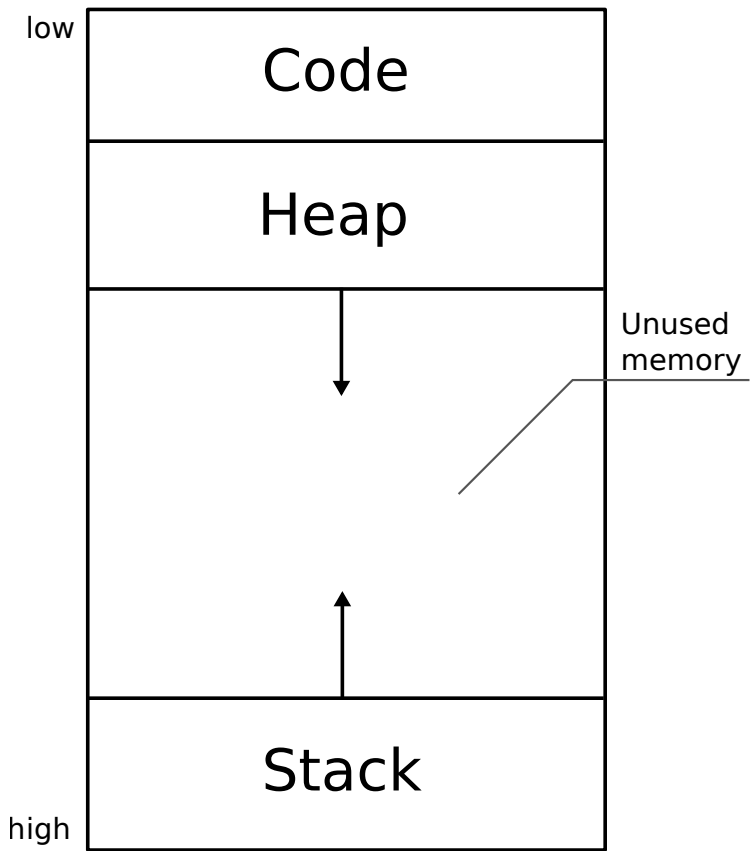
Strukturer ("Structs")

```
struct Person  person;

person.name[0] = 'B';
person.name[1] = 'o';
person.name[2] = 'b';
person.age     = 42;
```

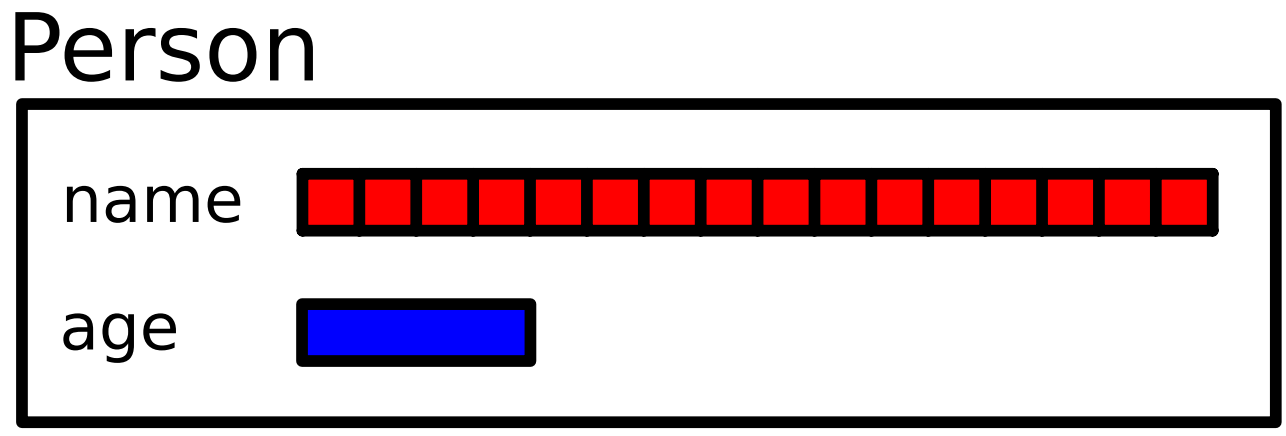
Strukturer ("Structs")

```
typedef struct Person Person;

struct Person {
    char name[16];
    int  age;
};


Person person;
```

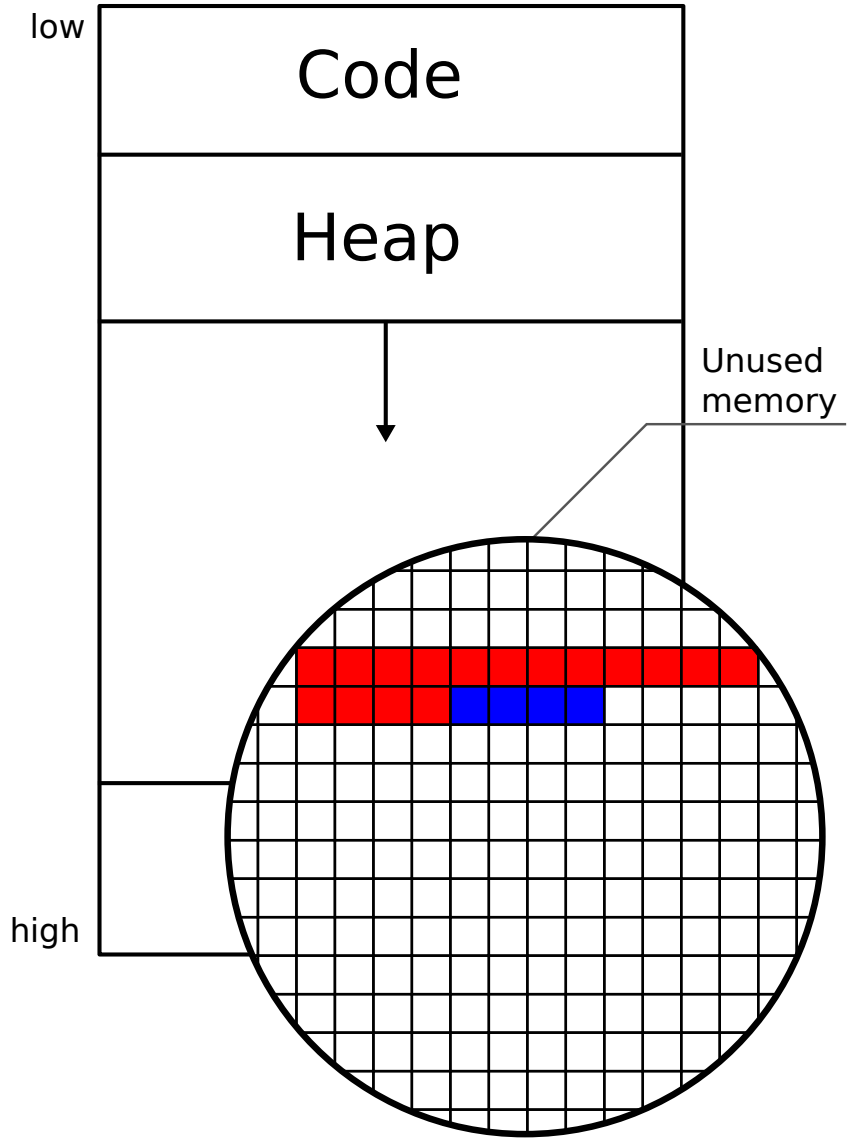
Sidespring: Stak vs. Heap



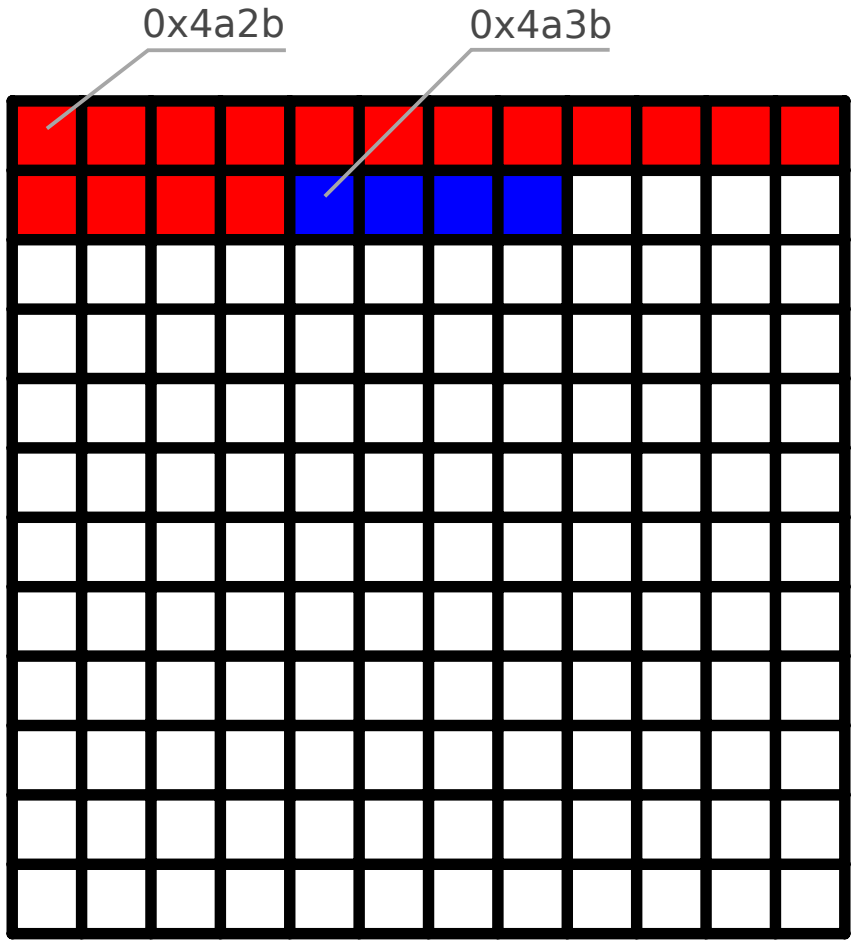
Sidespring: Stak vs. Heap



Sidespring: Stak vs. Heap



Sidespring: Stak vs. Heap



Pointers

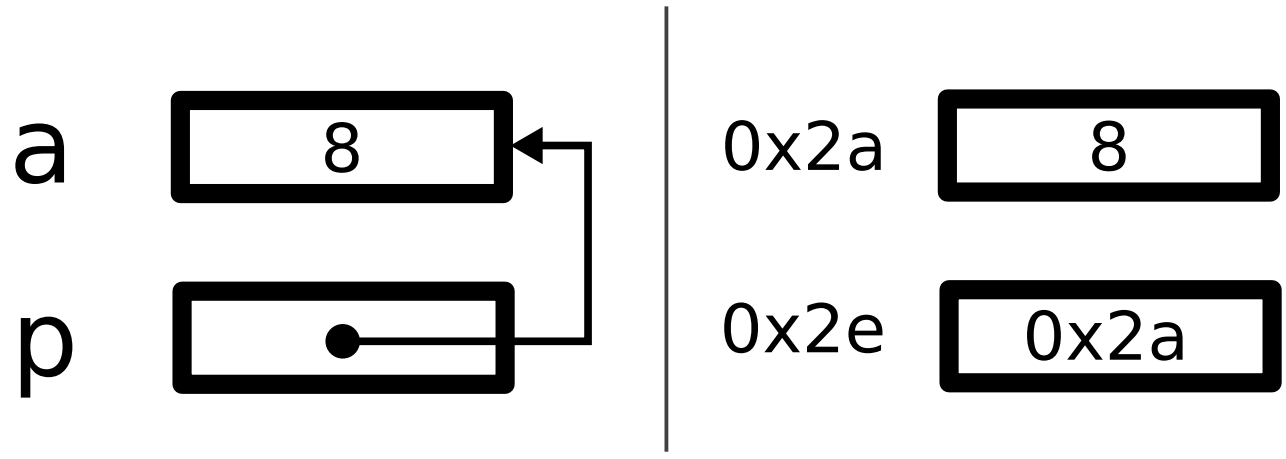
```
int  a = 8;
int* p = &a;
```

Pointers

```
int  a = 8;
int* p = &a;
```

```
*p = 32;
/* a is now 32 */
```

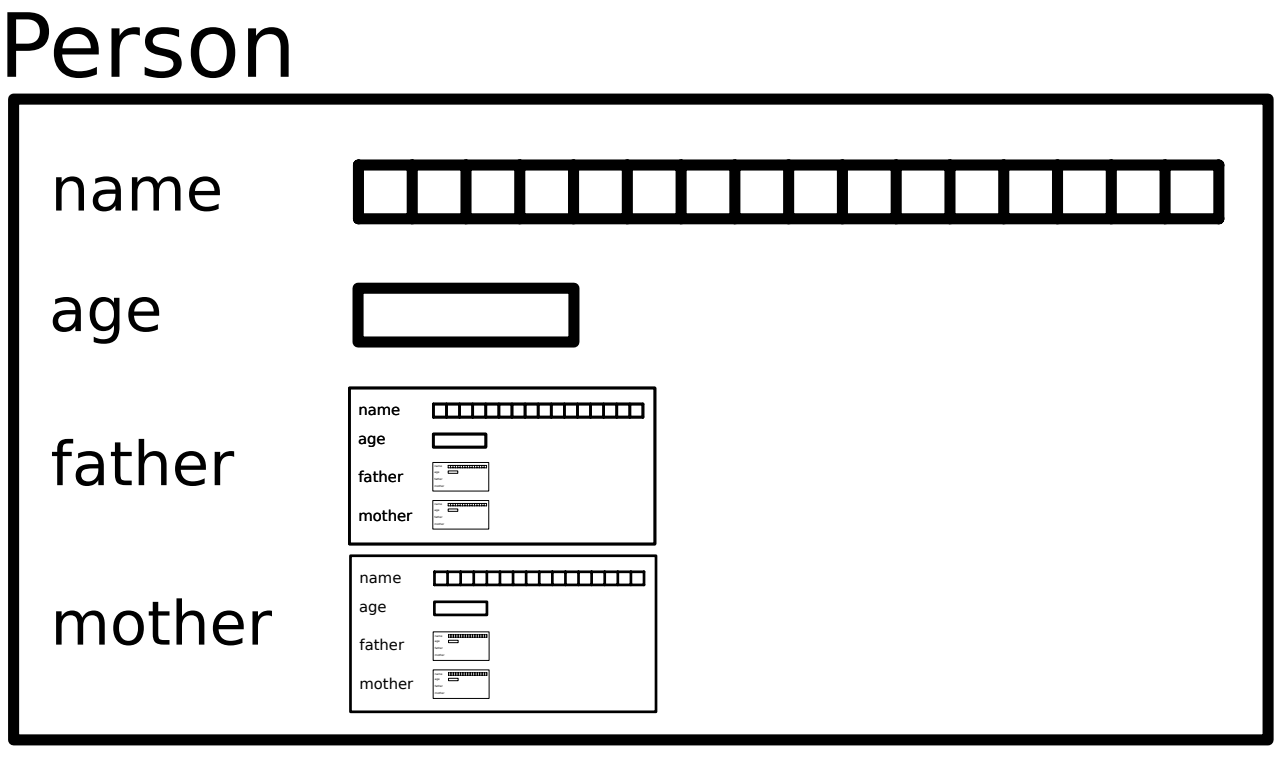
Pointers



Pointers & Structs

```
typedef struct Person Person;

struct Person {
    char   name[16];
    int    age;
    Person father;
    Person mother;
};
```

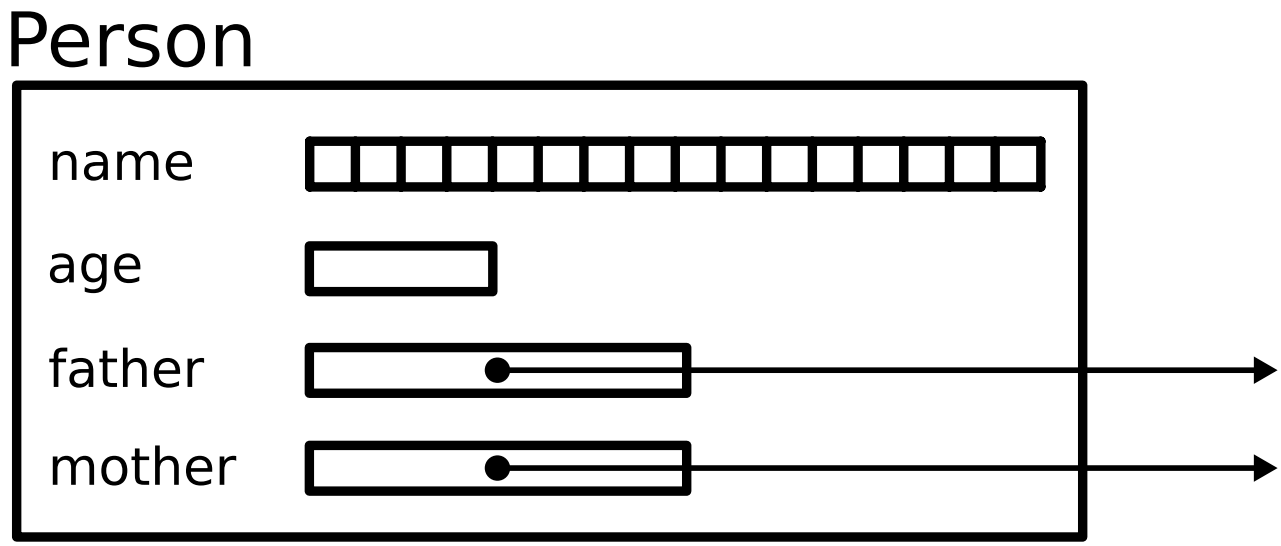
Pointers & Structs



Pointers & Structs

```c
typedef struct Person Person;

struct Person {
    char    name[16];
    int     age;
    Person* father;
    Person* mother;
};
```

Pointers & Structs



Pointers & Malloc

```
int* a = malloc(4);
*a = 42;
```

Pointers & Malloc

```
int* a = malloc(sizeof(int));
*a = 42;
```

Pointers & Malloc

```
Person* person = malloc(sizeof(Person));
person.age = 42; // Doesn't work!
```

Pointers & Malloc

```
Person* person = malloc(sizeof(Person));
(*person).age = 42;
```

Pointers & Malloc

```
Person* person = malloc(sizeof(Person));
(*person).age = 42;
person->age = 42;
```

Pointers & Malloc

```
Person* person = malloc(sizeof(Person));

person->father = malloc(sizeof(Person));

person->father->age = 83;
```

Pointers & Malloc

Constructors

```
Person* create_person(int age, Person* father) {
    Person* person = malloc(sizeof(Person));
    person->age    = age;
    person->father = father;
    return person;
}

int main() {
    Person* grandpa = create_person(83, NULL);
    Person* bob     = create_person(42, grandpa);
}
```

Pointers & Malloc

```
Person* person = malloc(sizeof(Person));
...
free(person);
```

Pointers & Malloc

Deconstructors

```
void destroy_person(Person* person) {
    /* Clean up other stuff */
    ...
    free(person);
}
```

Pointers & Arrays

```
int arr[16];

arr[5] = 17;
```

Pointers & Arrays

```
int arr[16];

arr[5] = 17;

*(arr + 5) = 17;
```

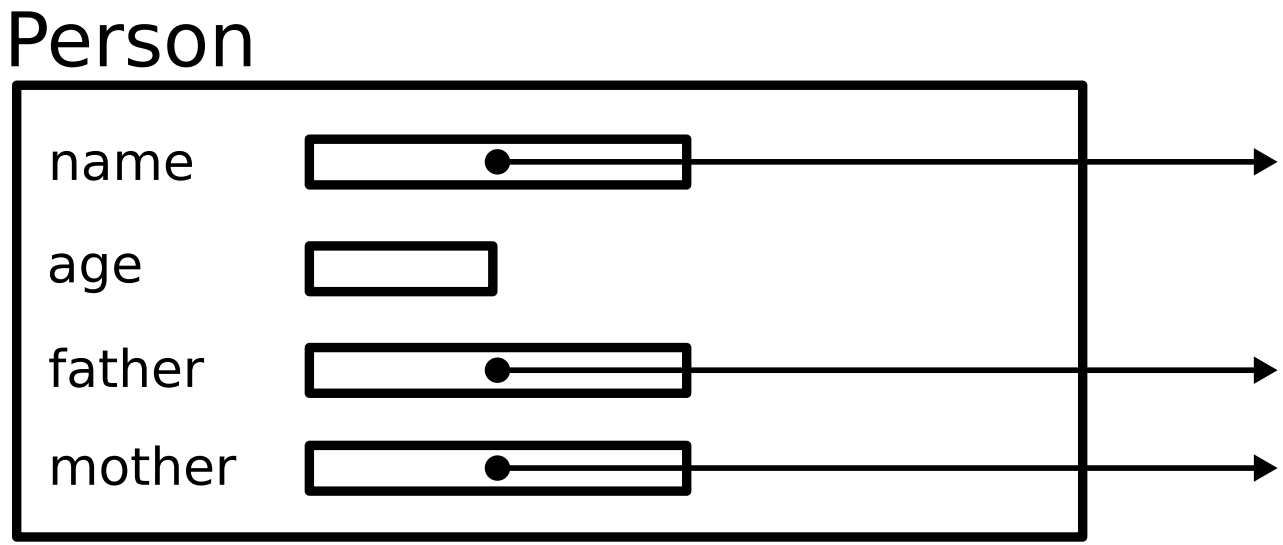
Pointers & Arrays

```
int* arr = malloc(16 * sizeof(int));

arr[5] = 17;

*(arr + 5) = 17;
```

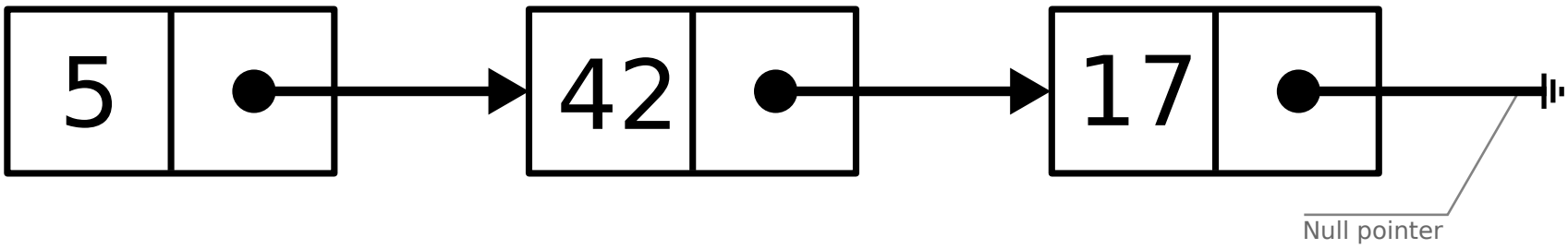
Pointers & Arrays

```c
typedef struct Person Person;

struct Person {
    char*   name; /* Instead of char name[16]; */
    int     age;
    Person* father;
    Person* mother;
};
```

Pointers & Arrays



Structs + Funktioner = Datastrukturer



Structs + Funktioner = Datastrukturer

```
typedef struct LinkedList LinkedList;

struct LinkedList {
    int          data;
    LinkedList* next;
}
```

Structs + Funktioner = Datastrukturer

```
LinkedList* linkedlist_create(int first_element) {
    LinkedList* ll = malloc(sizeof(LinkedList));
    ll->data = first_element;
    ll->next = NULL;
    return ll;
}
```

Structs + Funktioner = Datastrukturer

```
LinkedList* linkedlist_insert(int element,
                              LinkedList* list) {
    LinkedList* head = malloc(sizeof(LinkedList));
    head->data = element;
    head->next = list;
    return head;
}
```

Structs + Funktioner = Datastrukturer

```
LinkedList* ll = linkedlist_create(17);
ll = linkedlist_insert(42, ll);
ll = linkedlist_insert(5, ll);
```

Input & Output

```c
char name[64];
int  age;

printf("What is your name?\n");
scanf("%s", name);
printf("Hi %s!\n", name);
```

Input & Output

```c
char name[64];
int  age;

printf("What is your name?\n");
scanf("%s", name);
printf("Hi %s!\n", name);

printf("What is your age?\n");
scanf("%d", &age);
printf("Cool! My friend is also %d years old\n", age);
```

Input & Output

```
FILE* f = fopen("names.txt", "w");
fprintf(f, "Bob\n");
```

Input & Output

```
FILE* f = fopen("names.txt", "r");

char c;
while ((c = fgetc(f)) != EOF) {
    printf("%c", c);
}
```

Input & Output

```
FILE* f = fopen("names.txt", "r");

char buf[256];
while (fgets(buf, sizeof(buf), f)) {
    printf("line: %s", buf);
}
```

Opgaver

Vi mødes her igen kl. 14:15

Kodecafé

+ Evaluering