Exercises in System Level Programming (SLP) – Summer Term 2025

Exercise 4

Maxim Ritter von Onciul

Eva Dengler

Lehrstuhl für Informatik 4
Friedrich-Alexander-Universität Erlangen-Nürnberg

Lehrstuhl für Informatik 4
Systemsoftware

FAU

Friedrich-Alexander-Universität
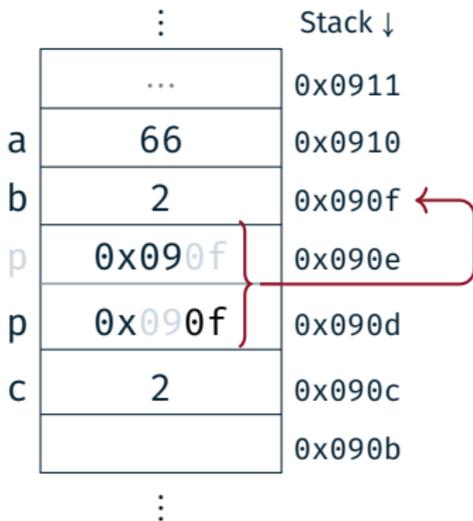Faculty of Engineering

Presentation Assignment 2

Pointers & Arrays

- Variable: `uint8_t x`
- Pointer: `uint8_t *y`
- Address-of operator: `&x`
- Indirection operator: `*y`

```
01  uint8_t a = 23;
02  uint8_t b = 42;
03  uint8_t * p = &a;
04  *p = 66;
05  p = &b;
06  *p -= 40;
07  uint8_t c = *p;
```

		Stack ↓
	...	0x0911
a	66	0x0910
b	2	0x090f
p	0x090f	0x090e
p	0x090f	0x090d
c	2	0x090c
		0x090b

Caution: ATmega328PB has 8-bit registers and 16-bit addresses
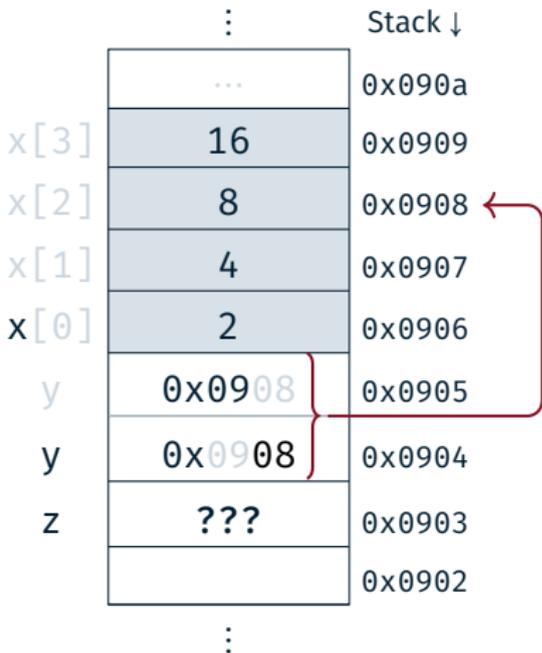
In depth: Arrays

- Constant pointer: `uint8_t a[]`
- Variable pointer: `uint8_t *b`
- Current element: `*b`
- x-th element: `b[x]`
- x-th element: `*(b+x)`

```
08  uint8_t x[] = {2,4,8,16};
09  uint8_t *y = x;
10  uint8_t z = x[1];
11  z = *y;
12  y = y+2;
13  z = *y;
14  z = x[7]; // ⚡⚡⚡
```

Undefined behaviour!

Access to an array outside of the
defined area

		Stack ↓
	⋮	
	...	0x090a
x[3]	16	0x0909
x[2]	8	0x0908 ←
x[1]	4	0x0907
x[0]	2	0x0906
y	0x0908	0x0905
y	0x0908	0x0904
z	???	0x0903
		0x0902
	⋮	

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Hands-on: Pointers

No Screencast

- Call-by-value vs. call-by-reference
- Pointer and arrays
- Pointer arithmetic
- `struct` for GPS coordinates
- Array of GPS coordinates
- Function pointers

Can be compiled for the SPiCboard (serial console), the SPiCsim or Linux

Source code:
https://sys.cs.fau.de/extern/lehre/ss25/slp/uebung/material/pointer.c