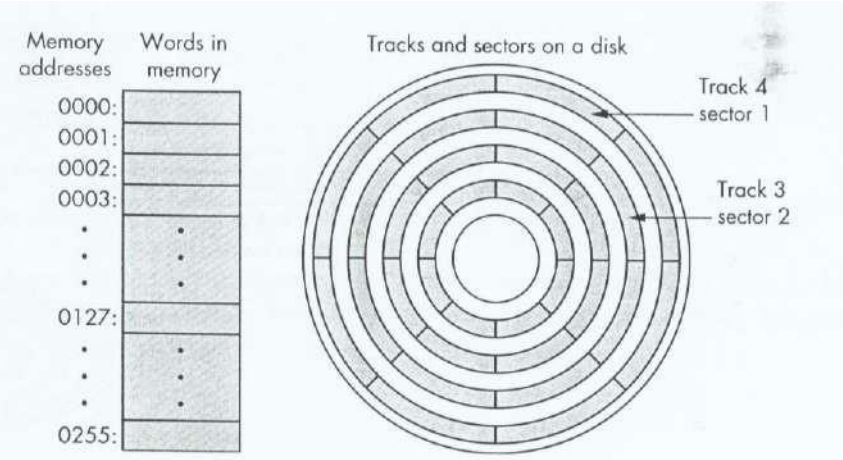
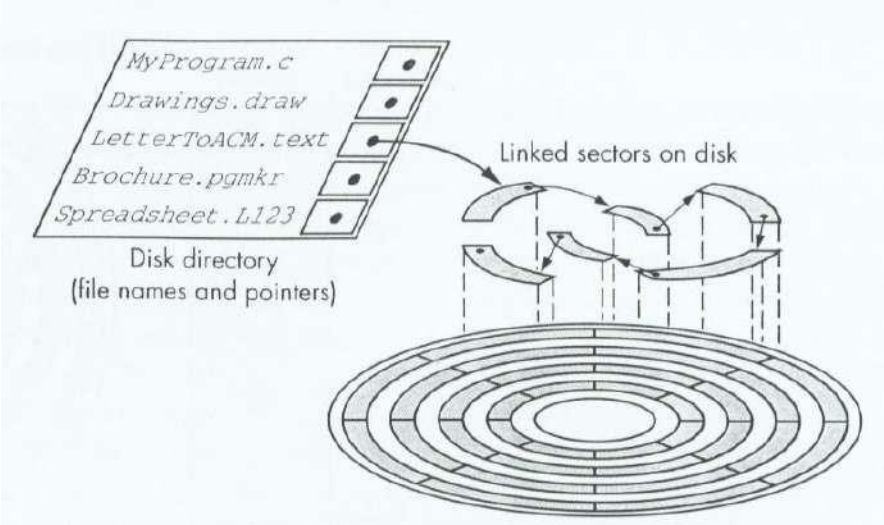
Fakultas Informatika
School of Computing
Telkom University

CCK2AAB4
STRUKTUR DATA

Introduction to Pointer and Address

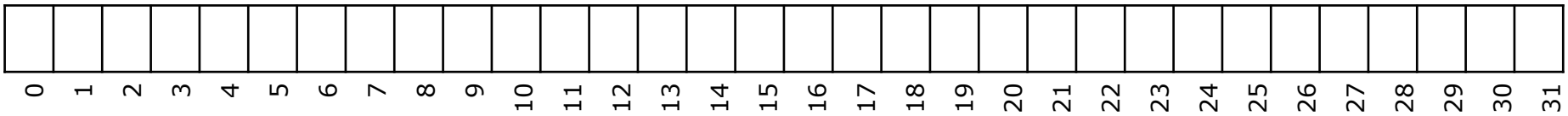
Representation of a Storage Media





Data and Memory

- Data of a variable is stored in memory
- Picture it as a 1-dismension array

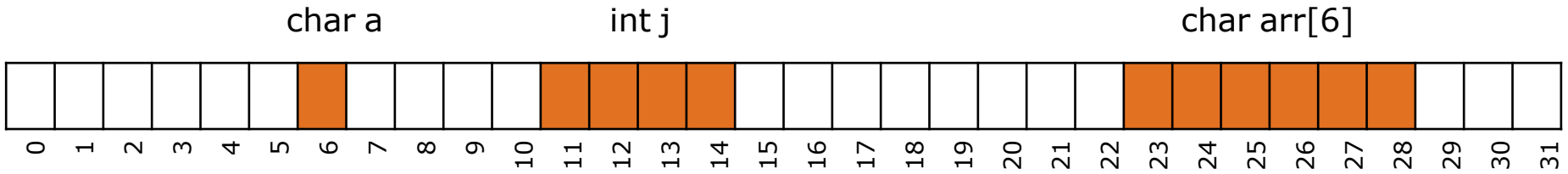


- Each cell has a unique "index", we call it **address**

Data and Memory

- While program runs, OS will allocate the memory space for each variable

```
Dictionary
    a : char
    j : integer
    arr : array [1..6] of char
```

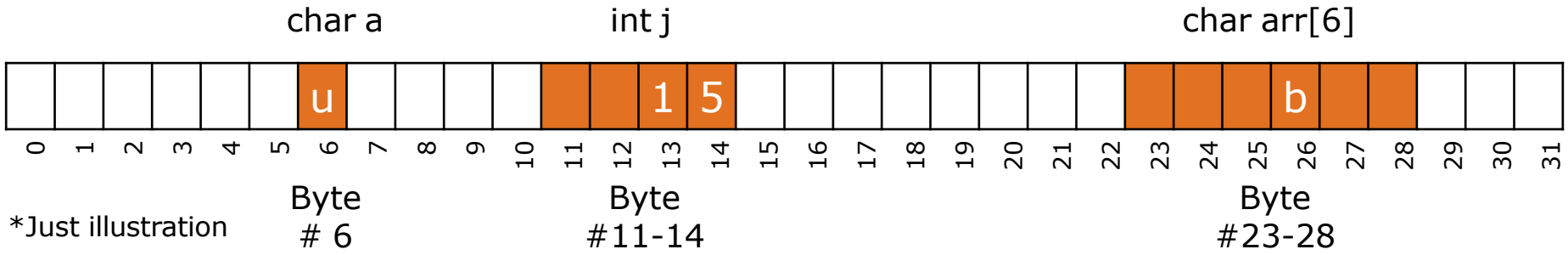


*Just illustration

Data and Memory

- We can call or change the value of a variable by calling the address where it's stored

```
Algorithm
    arr[3] ← 'b'
    a ← 'u'
    j ← 15
```

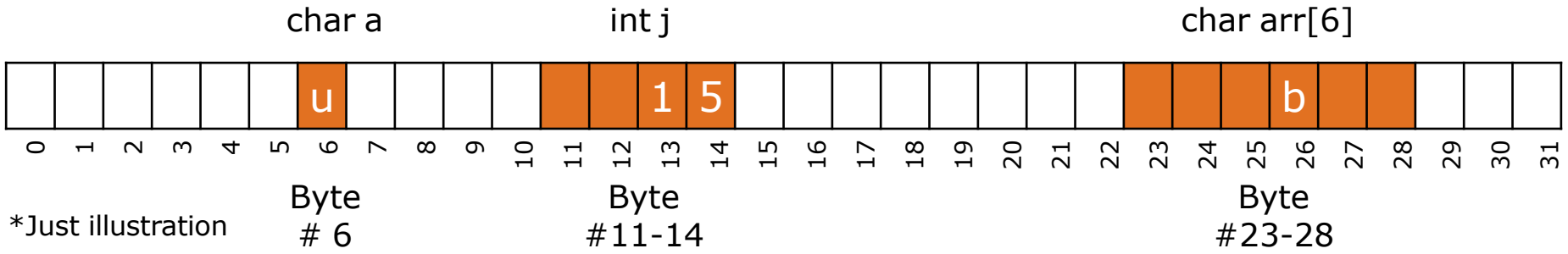


Data and Memory

- Specific for C/Cpp-family programming language, we can access the address of a variable using keyword '&'

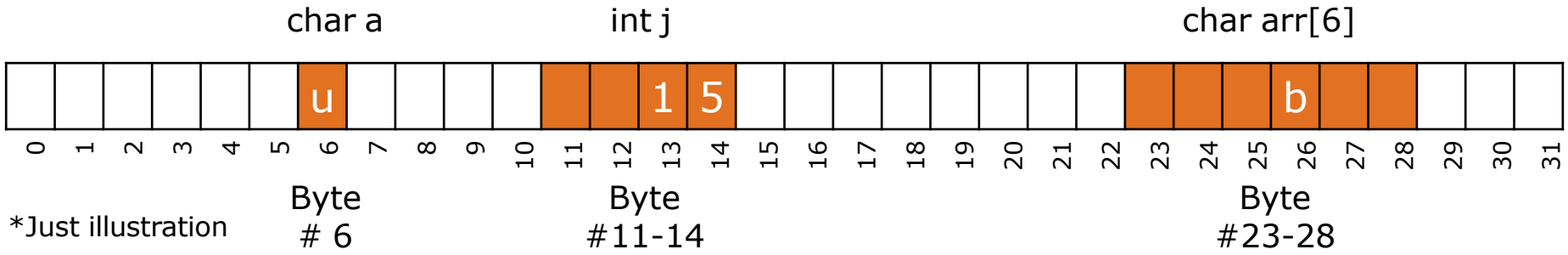
```
Algorithm
    output( a )
    output( &a )
    output( &arr[3] )
```

```
Output
u
0x6
0x26
```



Pointer

- Basic variable type
- Store an address of a variable in hexadecimal
- Size of an integer (4byte)

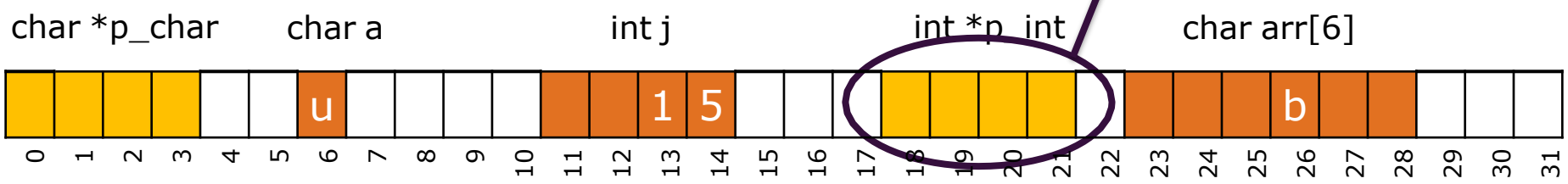


Pointer

- Pointer also has a variable type
- Can only points to variables of the same type

Dictionary
p_int : pointer to integer
p_char : pointer to char

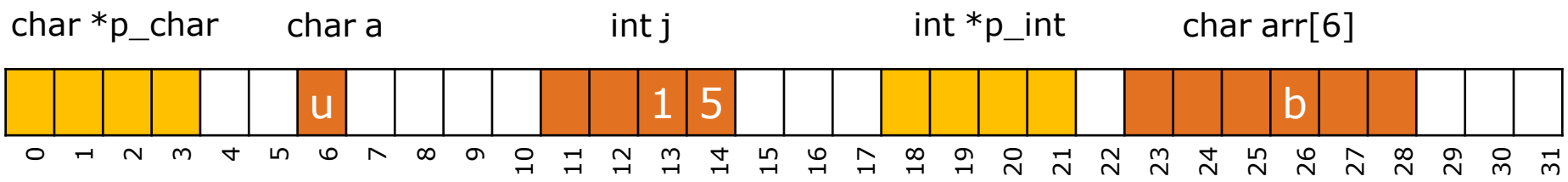
Pointer also use
Space memory



*Just illustration

Pointer (in pseudo code)

- For a pointer to refer onto a variable, just assign the variable into pointer
- Use keyword * to assign the value of a variable pointed by pointer



*Just illustration

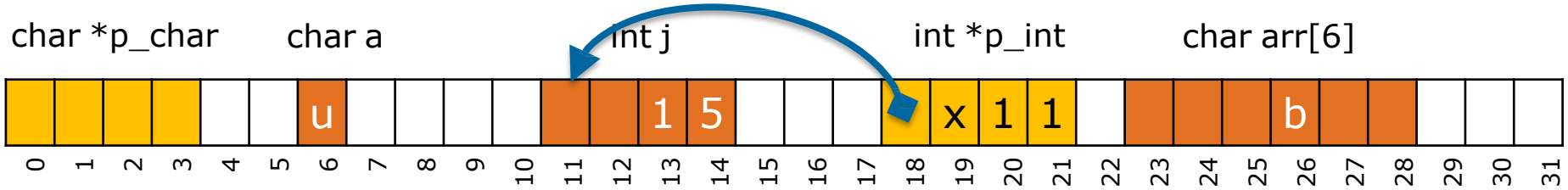
Operation using Pointer

Algorithm

```
p_int ← &j
output( j )
output( p_int )
output( *p_int )
```

Output

```
15
x11
15
```



Operation using Pointer

Algorithm

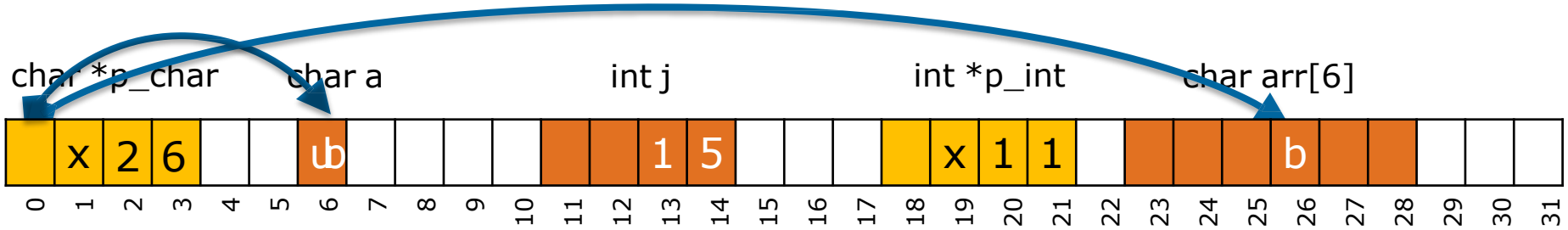
```
p_char ← &a
output( *p_char )
p_char ← &arr[3]
output( *p_char )
a ← *p_char
output( a )
```

Output

```
'u'  // pointing to a

'b'  // pointing to arr[6]

'b'
```

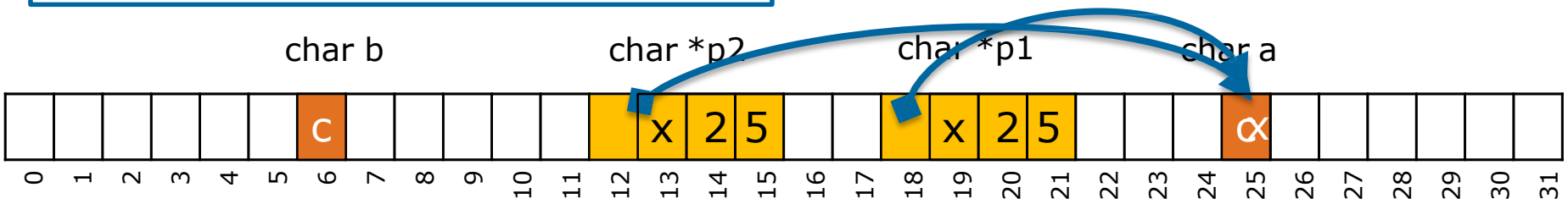


Pointers

- On Algorithm, pointer is about the value of the variable pointed
- Here we don’t talk about how to manually set a pointer to refer some address
- Program wise, it’s also not good to manually set a pointer into some memory address

Don’t be confused

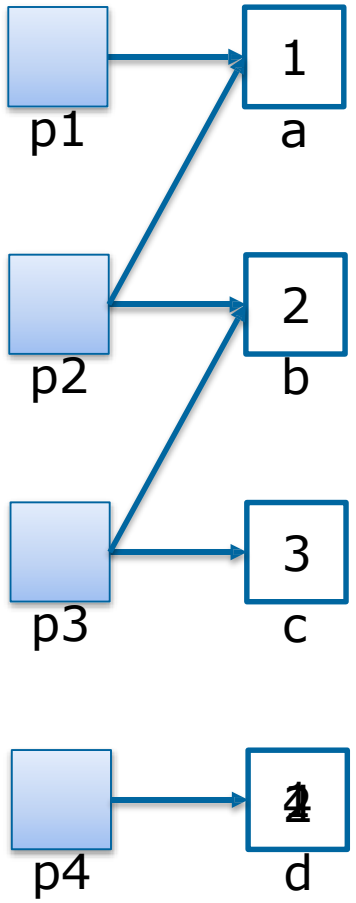
Dictionary
    a, b : char
    p1, p2 : pointer to char
Algorithm
    a ← ‘c’
    p1 ← &a
    p2 ← p1
    b ← *p1
    *p2 ← ‘x’



Don’t be confused

Dictionary
    a, b, c, d : integer
    p1, p2, p3, p4 : pointer to integer
Algorithm
    a ← 1
    b ← 2
    c ← 3
    d ← 4
    p1 ← &a
    p2 ← &b
    p3 ← &c
    p4 ← &d

    p2 ← p1
    *p4 ← *p1
    p3 ← &b
    *p4 ← b

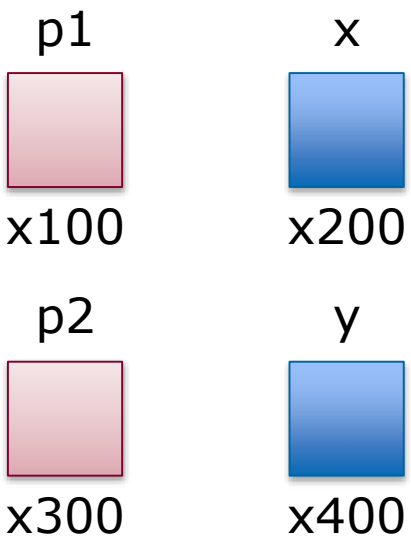


Question?

Exercise – draw the pointers

Dictionary
    x, y : integer
    p1, p2 : pointer to integer
Algorithm
    x ← 5
    y ← 10

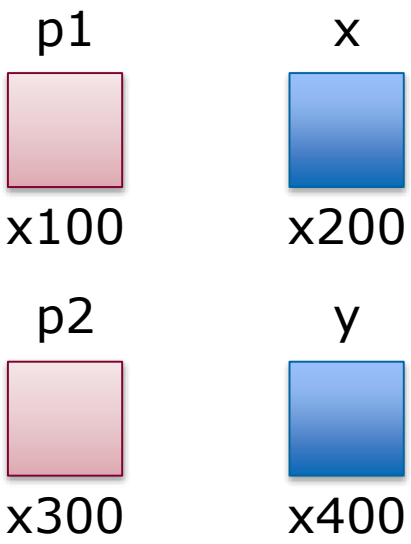
1	p1 ← &x *p1 ← 7
2	p2 ← &y x ← *p2
3	x ← y p1 ← &y p2 ← &x
4	p2 ← &x p1 ← p2 *p2 ← 6



Exercise – draw the pointers

Dictionary
    x, y : integer
    p1, p2 : pointer to integer
Algorithm
    x ← 5
    y ← 10

1	p1 ← &y p2 ← &x *p1 ← *p2
2	p2 ← &x *p2 ← 7 p1 ← p2
3	p1 ← &x *p1 ← y



Exercise – write the value inside each variable and pointer

Dictionary

a, b, c : integer

p1,p2,p3 : pointer to integer

Algorithm

a ← 10

b ← 15

p1 ← &b

p2 ← p1

c ← 27

p1 ← &c

a ← *p1

p3 ← &b

*p2 ← 8

What is the output?					
a	b	c	p1	p2	p3
10	15		1	2	3

Exercise – write the value inside each variable and pointer

Dictionary
    a, b, c : integer
    p1, p2, p3 : pointer to integer

Algorithm
    a ← 10
    b ← 15
    c ← 27
    p1 ← &a
    p2 ← &b
    *p1 ← c
    a ← *p2
    b ← 6
    p3 ← &b
    p3 ← &c
    *p1 ← *p3

What is the output?					
a	b	c	p1	p2	p3
10	15		1	2	3

Home Task

- Learn more about pointer in Cpp
- Create a project to try the previous exercise in Cpp
- Read more about Dynamic Memory Allocation

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THANK YOU