COMP20005 Workshop Week 7

1	**Arrays:** understanding, Ex 7.01, Ex 7.04
2	**Assignment 1:** Q&A, marking rubric **Lab:** • do your assignment 1 and make at least one submission,

Arrays: `int A[100]; int n= 0;`

Conceptually understanding:

- Array= a collection of same-type data containers
- array a of n elements $\Leftrightarrow$ mathematical sequences $a_0, a_1, a_2, \ldots, a_{n-1}$
- To use an array, we need 4 stuffs:
  - data type
  - name
  - size (ie. capacity)
  - buddy variable n for the length (ie. current number of elements)

Array in computer memory

- Array occupies a block of must-be-defined “size” cells in memory

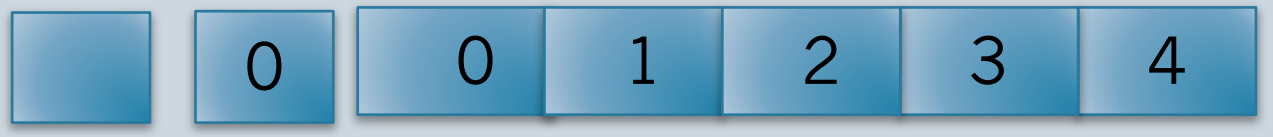
arrays: a collection of variables under a common name

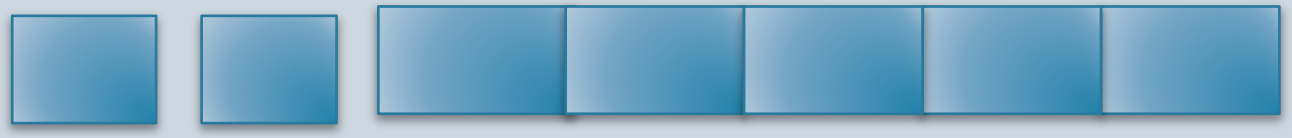
	statements	in memory(*after* running LHS)
1	`int i, A[5];`	
2	`A[0] = 10;` `i= A[0] * 2;`	
3	`i= 2;` `A[i]= 20;`	

4	`for (i=0; i<5; i++) {`
	`  A[i]= i*i;`
	`}`
		

5	`for (i=0; i<3; i++) {`
	`  scanf ( "%d", &A[i] );`
	`} /*` supposing input `10 20 30` `*/`
		

arrays...

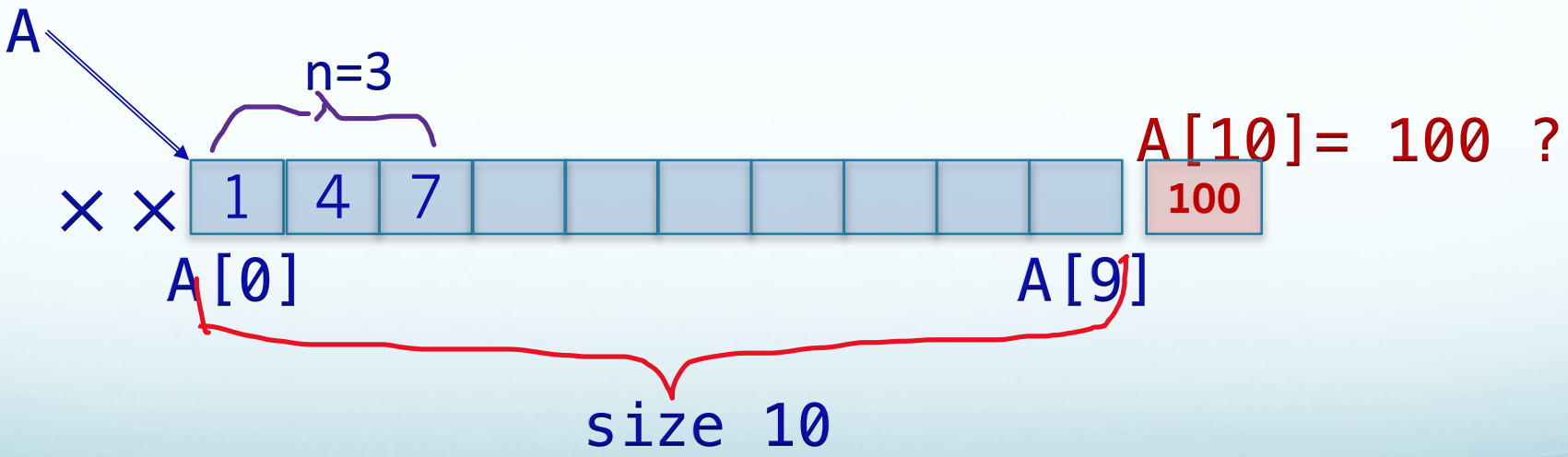
	statements	variables in memory
1	`int i, sum=0,` `  A[5]= {0,1,2,3,4};`	
2	`for (i=0; i<5; i++)` `  sum += A[i];`	

3	`for (i=0; i<4; i++) {`
	`  A[i+1]= A[i];`
	`}`
		

Chorus of the day: Array names are constant pointers!

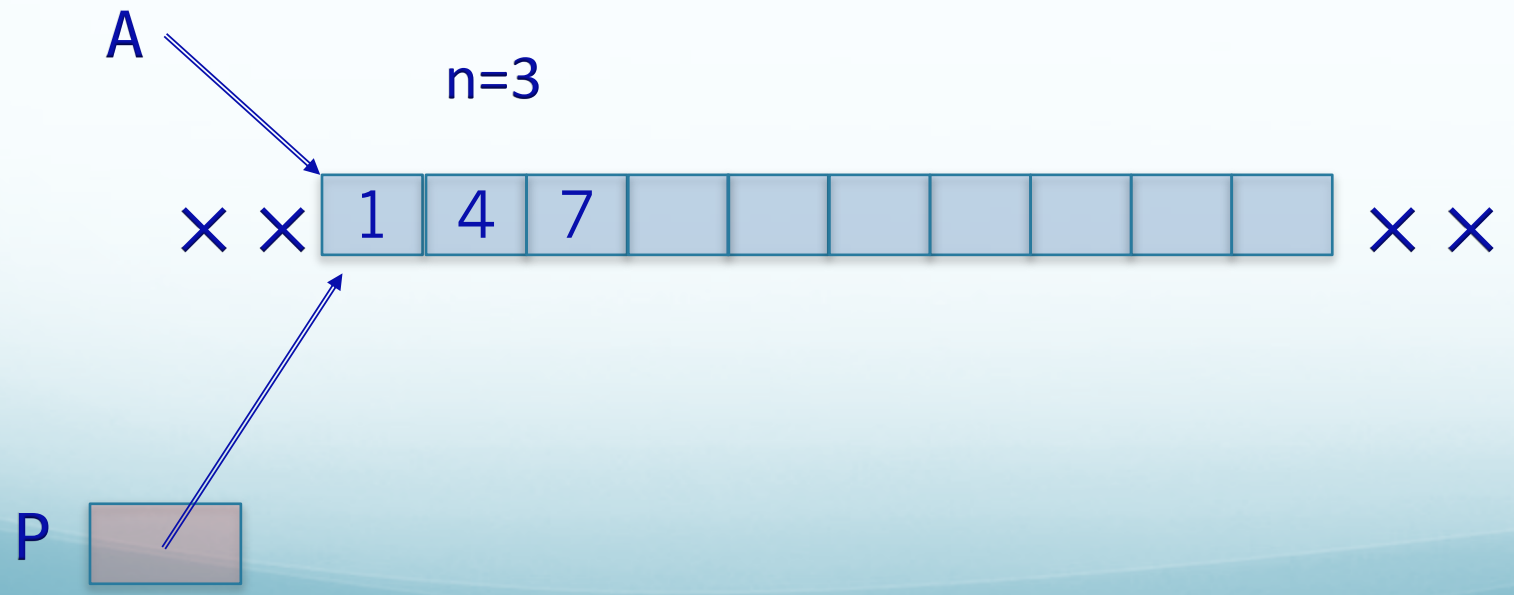
```
#define SIZE 10
int A[SIZE]= {1,4,7};  // A == &A[0]
int n= 3;
```

- the system remember the constant pointer `A`, but won't remember the value `10`,
- check ourselves and don't (wrongly) use `A[-1]`, `A[10]` or `A[11]` – a very infamous *Segmentation Fault* error!



Chorus of the day: Array names are constant pointers!

```
#define SIZE 10
int A[SIZE]= {1,4,7};
int n= 3;
int *p;          // p is a variable pointer
p= A;            // p now can be used as an avatar for A
                 // p[i] is the same as A[i]
```



Passing an Array to a Function

same as

```
int foo(int *A, int n)
```

Example of function

```
int foo(int A[], int n){
    int sum= 0, i;
    for (i=0; i<n; i++) {
        sum += A[i];
    }
    for (i=0; i<n; i++) {
        A[i]= 0;
    }
    return sum;
}
```

Example: using function

```
int B[]={1,2,3}, s;
s= foo(B, 3);
```

Pass:

- the `name` of the array
- the `current number` of elements

What function can do with this call:

use value `n` and array (= starting address) `B`

modify the elements of array `B`

Check your understanding

```
int sum(int A[], int n){
  int i, s= 0;
  for (i=0; i<n; i++) {
    s += A[i];
  }
  return s;
}
```

With the declarations:

```
int B[10]= {0,1,2,3,4,5,6,7,8,9};
```

For each of the following statements: valid? If yes, what's the output?

```
printf("%d\n", sum(B, 10));
printf("%d\n", sum(B+0, 5));
printf("%d\n", sum(&B[0], 5));
printf("%d\n", sum(B+4, 2));
printf("%d\n", sum(B+7, 4));
```

Discussion & DoTogether: Exercise 7.01, 7.04

7.01: (Write function `int all_zero(int A[], int n)` that returns 1 or 0)

7.04: *Write a program that reads as many as 1,000 integer values, and counts the frequency of each value in the input:*

```
./program
Enter as many as 1000 values, ^D to end
1 1 1 3 3 3 3 3 4 6 4 3 6 10 3 5 4 3 1 6 4 3 1
17 values read into array
Value Freq
    1    3
    3    5
    4    4
    5    1
    6    3
   10    1
```

How?

Ass1: Q&A

spec

skeleton code

sample data & expected output

marking rubric

grok or installed editor + gcc

sample solution of 2020

Discussion Forum

testing on GradeScope

Marking Rubric: The importance of Style & Structure

Stage	Presentation	Structure	Execution	max accumulated mark
1	+5	+2	+1	8
2		+4	+4	16
3		+0	+4	20
all	5	6	9	

Failed code could even get 11

Absolutely correct program could get only 9

Correct and good Stage 1+2 alone could get 16

ASS1 Marking Rubric: a few keys in Presentation [Q&A next week]

use of magic numbers, -0.5;
#defines not in upper case, -0.5;
unhelpful `#define`, -0.5
bad choices for variable names, -0.5;
bad choice for function names, -0.5;

use `#define` for meaningful constants
`#define`-ed names should be in upper case
variable names in lower case (except single-letter array name)
variable names should be expressive

absence of function prototypes, -0.5;

add function prototypes before main()
main() should be the first function body!

inconsistent bracket placement, -0.5;
inconsistent indentation, -0.5;

you can use sample programs in lectures as the model

excessive commenting, -0.5;
insufficient commenting, -0.5;

each function header should have a comment
add comments for non-trivial code segment

lack of whitespace (visual appeal), -0.5;
lines >80 chars, -0.5;
use of constant subscripts in 2d arrays, -1.0;
other issue: minor -0.5, major -1.0
empty program, or helloworld, or etc, -5.0;

- comment at end that says ”programming is fun", +0.5;
- overall care and presentation, +0.5;

DO IT !
Easy way to get back 0.5 or 1 mark

ASS1 Marking Rubric: a few keys in Structure

global variables, -1.0;

Global variables are NOT allowed!

main program too long or too complex, -1.0;
functions too long or too complex, -0.5;
overly complex function argument lists, -0.5;

function should not be long
and should not have too many arguments

insufficient use of functions, -0.5;
duplicate code segments, -0.5;

when having a few line, or a complicated line similarly-duplicated, think about creating a new function!

overly complex algorithmic approach, -0.5;

avoid too many levels of nesting `if and` loops
don't make the markers wonder too much to understand your code!

unnecessary duplication/copying of data, -0.5;

For example, think carefully before you copy an array!

other structural issue: minor -0.5, major -1.0;

overly complex algorithmic approach, -1.0;

Examples of overly complex algorithmic approach :

- sort the data when not actually required
- too many levels of nested loops/if

duplicate code segments: turn similar segments into a function

When?

- having a block of >=2 lines appears in more than one place?
- copying a code segment to another place and change a bit?

Solutions to avoid:

- Build a loop
- Form a new function for the duplicated part
- …

ASS1 Marking Rubric: a few keys in Execution

failure to compile, -4.0;
unnecessary **warning messages** in compilation, -1.0;

Your program might be compiled OK in your computer.
But it might have compiler errors or warnings on other machines.

→ carefully read the verification report after a submission
(compiler messages are at the beginning of the report)

incorrect Stage 1 layout or values in any test, -0.5 or -1.0 or -1.5;
incorrect Stage 2 layout or values in any test, -0.5 or -1.0 or -1.5;
incorrect Stage 3 layout or values in any test, -0.5 or -1.0 or -1.5;

Again, check the verification report!
When testing compare your outputs with expected outputs using command `diff`:

```
./ass1 < argyle-00050.tsv > out1.txt
diff out1.txt test1-out.txt
```

Desirable outcome: EMPTY output from command `diff`.
If you have non-empty output:
+ The lines starting with **<** is from the first file of the `diff`
+ The lines starting with **>** is from the second file
+ You can just do the submit to see the output of `diff`

Ass1: Maximize Your Mark

- *Check your code against the marking rubric*
- *Examine the 2020 sample solution: you don't need to understand, but you still can learn many from here*

Special Attention from the marking rubric:

missing Authorship Declaration at top of program, -5.0;

incomplete or unsigned Authorship Declaration at top of program, -3.0;

use of external code without attribution (minor), -2.0;

use of external code without attribution (major), -10.0;

significant overlap detected with another student's submission, -10.0;

LAB: do Assignment 1

For assignment 1, you can use VS/gcc (preferable), or grok.

- Build your code.
- Do a submission on GradeScope right now during the workshop!
- ***LEARN FROM SAMPLE SOLUTION FOR 2020 before doing stage 1***

There is an additional tool in grok: the `Makefile`. You can also copy that `Makefile` into your VS directory (but you must name your code `program.c`) and try.

Command	Explanation
`ls`	see the list of files in the current directory, you should have, and should see `program.c` listed out
`make`	compile your `program.c`
`make run1`	run your code with data set 1
`make test1`	test your code with data set 1, it will output the *differences* (if any) between your output and the expected output

Assignment 1: how to start

	using VS/gcc or equivalent	using grok
preparation	• make a new folder, say `ass1` • copy `ass1-skel.c` to, say, `ass1.c` in the `ass1` folder • open `ass1.c` and sign in the Declaration • download all files listed in Test data into folder `ass1`	using Assignment1
programing	fill in your code in `ass1.c`	edit/fill in your code in `program.c`
testing	see next page	to run the test for data set 1, use Terminal, do: `make test1`
submitting	follow instructions in LMS→Assignments→Assignment 1	

Assignment 1: A reasonable way to start with VS/gcc

	command/action	explanation
1	`cd ~`	set your home directory as your *current directory*
2	`mkdir ASS1`	*make a new directory, and of assignment files will be placed in that directory*
3	`cd ASS1`	*change current directory to ASS1*
4	`ls`	*list the content of the current directory, it should be empty*
5	navigate to the assignmen1 page and download file `ass1-skel.c`, and all the test and expected test-output files. Download the files to the `ASS1` directory.	
6	`ls`	*now you should see the downloaded files*
7	`mv ass1-skel.c ass1.c`	*rename the skeleton file to your assignment*
8	using VS `editor` to edit `ass1.c`	
9	`gcc –Wall –o ass1 ass1.c`	*compile the program*
10	`./ass1 < test0.txt > test0-myout.txt`	*run program with redirection*
11	`diff test0-myout.txt test0-out.txt`	*check if your output is the same as the expected*

A1: Test your code by doing a submission

NOW: do at least one submission, even with empty code

LEARN FROM SAMPLE SOLUTION FOR 2020

When: *when your code is free compiler errors*

How:

- *Submit on GradeScope & Wait for the verification report*
- *Read the verification report carefully, pay attention on:*
  - *compiler messages at the start of the report, if any*
  - *the differences between your and the expected outputs*

Notes*:*

- *You can submit as many times as you want*
- *Submit early to avoid unexpected technical problems*
- *Your program might work perfectly in your computer but fail in the testing computer(s).*

A1: Test your code in your system or in grok

TESTING IN YOUR COMPUTER

Using redirection when running/testing your program:

```
./myass1 < test0.txt > test0-myout.txt
```

Your program's output must be the same as the expected, ie. the command

```
diff test0-myout.txt test0-out.txt
```

must give empty output (that is, no difference).

IN grok: use Terminal to run

```
make test0
```

Remember:

your code might work well on the supplied data sets, but fail on some other…

Compiler warnings: -2.0

COMP100 02.Workshop A

ASS1 Q&A:

COMP20005
.Workshop.A

Additional Slides

Discussion 3: typedef and struct for exercise 7.5

Suppose that a set of "student number, mark" pairs are provided, one pair of numbers per line, with the lines in no particular order. Write a program that reads this data and outputs the same data, but ordered by student number. For example:

```
823678  66
765876  94
864876  48
785671  68
854565  89
```

On this input your program should output:

```
Enter as many as 1000 "studnum mark" pairs, ^D to end
5 pairs read into arrays
studnum  mark
765876  94
785671  68
823678  66
854565  89
864876  48
```

Hint: use two parallel arrays, one for student numbers, and one for the corresponding marks. You may assume that there are at most 1,000 pairs to be handled.

Discussion 3: typedef and struct for exercise 7.5

Use `typedef` *to define a new data type.*

Use struct to define a multi-component data type. For example:

```
typedef struct{
    int stud_id;
    double mark;
} student_t;

/*  return the average mark of n students,
    the pairs (student_id, mark) are stored in array A[]  */
double average_mark(student_t A[], int n) {
    …
}
```

Discussion 3 :exampe of using typedef and struct

```
#include <stdio.h>
typedef struct{
    int stud_id;
    double mark;
} student_t;

int main(...) {
    student_t s1= {211111, 99.5}, s2;
    student_t A[10];
    int i;
    s2= s1;
       s2.stud_id= 1000001;
    printf("id= %d mark=%f\n", s1.stud_id, s1.mark);
    for (i=0; i<10; i++) {
            scanf("%d %d", &(A[i].stud_id), &A[i].mark);
    }
```

Discussion 3: typedef and struct for exercise 7.5

Suppose that a set of "student number, mark" pairs are provided, one pair of numbers per line, with the lines in no particular order. Write a program that reads this data and outputs the same data, but ordered by student number. For example:

823678 66
765876 94

We can start with, for example:

```
typedef struct{
   int stud_id;
   double mark;
} mark_t;

#define SIZE 30000
int main(…) {
   mark_t unimelb[SIZE];
   int n= 0;
   ...
```

And write functions to:

- input data to an array of `mark_t`
- sort an array of `mark_t`
- ouput data of an array of `mark_t`

Remember to a) create a data file, and b) use redirection for inputting data.