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C Course

Outlines :-

1. Introduction to C
2. Control Statements.
3. Array
4. Array of characters.
5. functions & structures.
6. pointers part1
7. pointers part 2.

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Introduction to C

* Programing : is the process to create a program.

- Program : is set of ordered instructions that enable a computer to carry out a specific task to solve human problems.

* Hardware : Any physical component is hardware.

- Computer hardware can only understand electrical signals (on_off).

* Software : collection of computer programs and related data that provide the instructions for telling a computer what to do & how to do.

- Software Life cycle : _ Gathering requirement, Analysis, Design, Developmant, testing, Developmant, maintenance.

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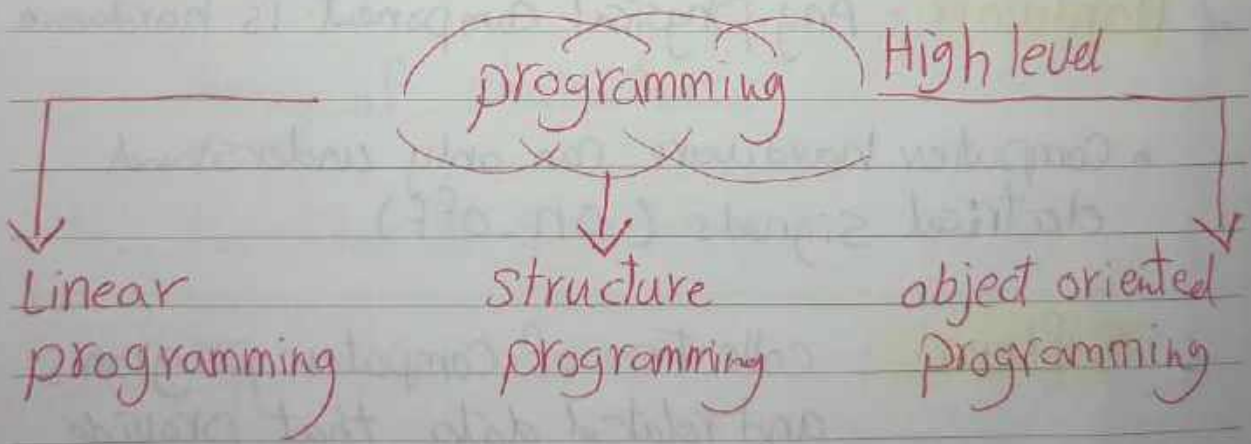
Testing :

- unit test
- Functional test
- performance test
- stress test
- user Acceptance test.

Deployment :

- Direct
- parallel
- phase



1- Linear programming :

يبدأون من أول سطر .
ماشي بترتيب الأوامر اللي أنا بكتبها لو عايزة أرجع لـ statement يرجع اكتبها تاني

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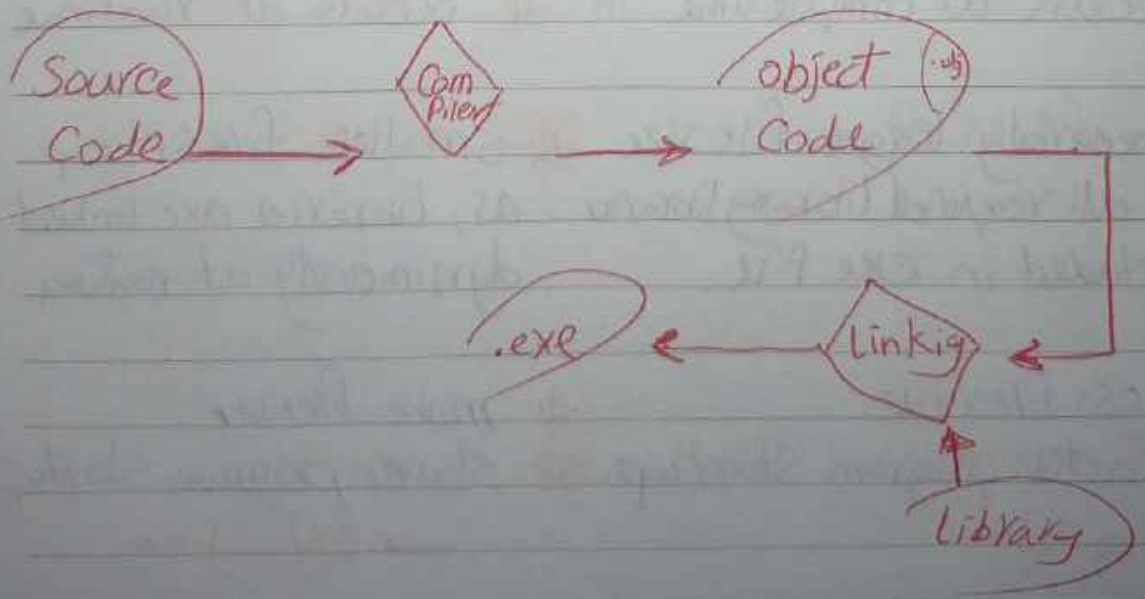
2- Structure programming :

- يبدأ من ال main function
باخد الكود المكرر وأحطه في block اللي هو (function) كل function بيبقى فيها مجموعة من ال statements

* لازم أراعي الـ maintenance بتاع الكود اللي هو :-
* أراعي اني لما أرجع بعد سنة مثلا أعدل في ال statements يبقى الموضوع سهل
* رده اللي خلاهم طوروا من pl بداية من ال linear لحد ال oop



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Linking

Static

* executable file include the library inside itself
  الموزر مش محتاج يتزل وقت ويرضاربه
* process of combining all necessary libraries and external references into a single executable file at compile time.
* occurs at compile time
* Generally larger file size so, all required library libraries included in exe file.
* Less flexible
* Faster program startup
  → C

Dynamic

* process of linking external libraries & references at runtime. when the program is loaded or executed.
* occurs at runtime
* smaller file size, as, libraries are linked dynimacly at runtime
* more flexible.
* slower program startup.
  → C#, Java

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Notes!

- 1 byte = 8 bit.
- 1 byte (not signed) Range →
  (0 → 2^8 - 1).

- 1 byte (Singed) → 0 → 2^7 - 1
  (1 bit for sign) -1 → -2^7

- Binary System → (0,1)

- الكهرباء بتدخل الكمبيوتر على هيئة 0,5 Volt
عشان كده الكمبيوتر مبيفهمش إلا 1,0 واختصارا ان لو
نور هتبقى 1 ولو مفيش يبقى 0.

- floating data → m * 10^n

- Decimal System Range (0 → 10^n - 1)

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Why C

- C is a widely used portable high level programming.
- Mid level language.
- Compact, fast and powerful.
- C is the native of language of unix.
- Many languages have a pedigree (سلف)
- used for embedded programming.

C history

- 1972 : By Dennis Ritchie at Bell labs.
- 1978 : By Brain kernighan & Dennis | K&R C
- 1989 : ANSI C standard ✓
- 1999 : C99 standard.

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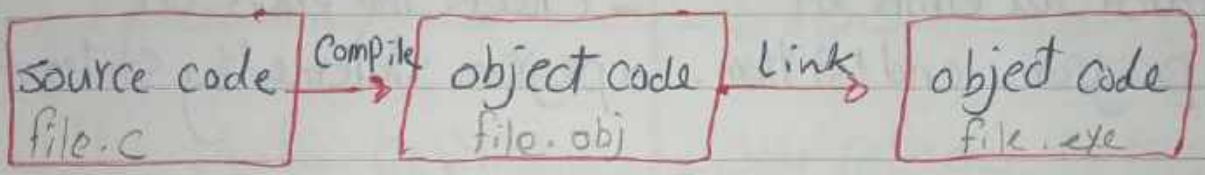
C program Life Cycle



IDE — Integrated Devevelopment Environment

→ Software that is used to edit, compile and link a programs to produce executable programs

* Compilers & interpreters are used to convert high level language code into machine language
high level program → known as source program
machine level program → known as object program.

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Compiler	interpreter
- Search all errors of a program and list them.	- Check the errors of a program statement by statement.
- Compiler takes entire program as input	- Interpreter takes Single instruction as input.
- intermediate object code is generated.	- No intermediate object code is generated
- program need not be compiled every time.	- every time higher level program is converted into low level.
- Errors are displayed after entire program is checked	- Errors are displayed for every instruction interpreted.
C, C++	Basic.

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Static Linking	Dynamic Linking
- Extension .lib	- Extension .dll.
- The data copied on every executable file.	- Only reference to the library on the executable file.
- The executable file run without need of the library file.	- Executable file need library to run.

Errors
- Synax error
- Logical error (runtime).
- Warning.

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Notes!

- C is case sensitive.
- C has free-form line structure
  (Statement ends with Semicolon)

- C program starting point is identified by main().
  this informs computer to where program actually starts.
- { } → Signify the begin and end segment of program.

Header files

- Contains declarations of functions & variables which can be incorporated into any C program by using the preprocessor #include statement.

- Standard header files are provided with each compiler and cover range of areas :- String handling, mathematics, data conversion, printing and reading of variables.

- must written in the beginning of the file.

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- All header files have the extension .h and generally reside in the /usr/include.

- The use of angle brackets < > informs compiler to search the compiler's include directories for specified file.

- The use of double quotation " " around filename inform compiler to start search in the current directory for the specified file.

* #include <stdio.h> → Directive statements

Ask preprocessor to included content of file stdio.h.

Storing Data | Variables

Memory

Binary system

ASCII table

Data types

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Variables

is a named memory location in which data of a certain type can be stored.

OR

is a symbolic name associated with a value and whose associated value may be changed.

- Variable has (mutable value, data type, location in memory and name or identifier).

datatype identifier ;

Identifier

is the name of variable by which we access the data stored in the variable or the location of the variable in the memory.

- Vary from one to 32 character.
- first char must be a letter or underscore.
- musn't use reserved words
- Camel & Pascal casing
- Name → description

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Memory

refers to the physical devices (Hardware) used to store programs (sequences of instractions) or data on a temporary (RAM) or permanent (Hard Disk) basis for use in a computer.

Datatypes

Type keyword	Data type name	Size in bits	Minimal range
char	character	8 (2byte)	-128 - 127
int	integer	32 (4byte	-32,768 - 32,767
float	Floating_point	32 (4byte	6 digits of percision
Double	Double floating point	64 (8byte)	10 digits of percision

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Format Specifiers

- character → %c
- Decimal integer → %d
- octal → %o
- hexadecimal → %x
- Long int → %ld
- floating point → %f
- double → %lf
- string → %s

Number of arguments must match the number of format specifiers

printf is a function in C used to output data to user on screen

- the first argument of printf is called control string.

printf (control string , argument list)

literal text / format specifiers / special chars.

variables, constants, expres

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scanf is a function in C which allows the program to accept input from the keyboard

scanf (control string , address list)

control string → format specifier

address list → specify memory location of variable

& → address operator.

*Some of functions

→ getch() : conio.h (Console input/output)
- gets a character from user.

→ clrscr() : conio.h
- clear the screen.

→ gotoxy (x,y) : conio.h
- move the cursor position.

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operators

1_ Arithmetic operators

- unary
  - one operand.
    - ++ , --
- Binary
  - two operands
    - + , - , * , / , %

2_ Assignment operators.

assign from rigth to left.

= , += , -= , /= , *=

3_ Relational operators.

return 0 , 1

== , != , < , > , <= , <=

4_ Logical operators

! , && , ||

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5_ Bitwise operators :_

& , | , ^ ; << sheft left , ~ compelent

6_ Ternary operator (conditional operator)

var = condition ? value1 : value 2_

operator precedence

unary → multiplicative → additive →
relational → equality → logical and →
logical or → assignment.

control statement

Conditional Statements
↓
if else
switch case

Loop statements
↓
for
while
Do while.

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* Conditional statements make a program smarter by allowing different choices.

if Statement

allows decision making depending on a condition

Switch Statement

- all conditions are equality conditions and data type of var is only int or Char.
- integer control expression is evaluated.
- terminate when a break statement is reached.
- Case must be unique & Const

for ⟵ عدد مرات التكرار معروف

While ⟵ أ check عملحاجة وعدد مرات التكرار مش معروف

dowhile ⟵ على الأقل هينفذ مرة واحدة وعدد مرات التكرار مش معروف

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prefix & postfix

ببساطة القيمة مش بتتغير على ال operand بتاعها، بتتغير بس في أي operation تانية

مثال :-

```
x = 10;
y = ++x;
```

↓

- عشان ++ جاية الأول فهيزود على x الأول وبعدين يعمل الحاجة اللي بعدها

يعني :-

```
x = x+1
y = ++x   (x+1)
```

y = 11
x = 11

طب x زادت واحد ليه؟؟

برضو زي التانية عشان عايزود بخزن القيمة في x مش مجرد يعمل العملية وخلاص لأن ++x = x+1

```
x = 10;
y = x++;
```

↓

- عشان x جاية الأول فيخلي ال x بنفس القيمة بتاعتها من غير مايزود وبعدين في هيزود واحد عليها

يعني :-

```
y = x++   (لسه x)
x = x+1
```

y = 10
x = 11

طب x زادت واحد ليه؟؟

عشان لما يزود يخزن القيمة في x مش مجرد يعمل العملية وخلاص لأن x++ = x+1

وقيمة ال x في الاثنين بتأكد لي على اللي قولته فوق ان القيمة مش بتتغير على ال operand نفسه اللي هو x

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* Magic box :-

عبارة عن box بيحقق إن مجموع كل صف = مجموع كل عمود = مجموع القطر = 15

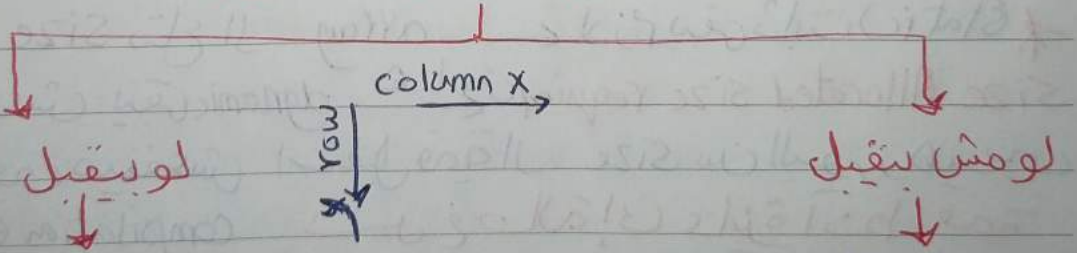
فى ناس حطوا rules معينة عشان اعلمكده من ضمنها ال rules دى :-

1- الرقم اللى لازم يبدأ بيه لازم يبقى odd اللى هو ال size بتاع ال matrix يعنى مثلا 3x3

2- case1 انه هيطبع 1 ← row = 1 فى أول صف

column = $\frac{size}{2}+1$ فى العمود ال middle

2- case2 الرقم اللى قبله يقبل القسمة على size



فى نفس column بس مش هزود يعنى

عن طريق gotoxy(column, row) ← طب هتتحرك على screen ازاى؟

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Array

- Data structure which hold multiple values of the same data type (homogeneous)

- fixed size.
- indexed.
- Not scattered.
- Static Allocated size required.
- indexing starts at zero.

* Array like other variables, must be declared before they can be used.

* (Static) لازم يبقى ثابت ← array الـ size بتاع الـ
Size Allocated size required هيا بقى dynamic مينفعش يبقى
. يعنى مينفعش استقبل قيمة الـ size من اليوزر هيبقى
compilation error فى حالة إنى عايزة أحط قيمة
الـ size فى variable أقدر أعمله عن طريق
الأول
```
# define size 3
int id[size];
```

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* During declration cosecutive memory locations are reserved for the array and all its elements.
يعني بيحجز الأماكن المتتالية بتاع كل elements ورا بعض

* After declration, you can't assume that the elements have been intialized by zero.
يعني متفتكرش اعلانكده

```
int id[5];
id[5] = {9, 1, 3, 2, 5};
```

* لو الـ intitial elements أقل من الـ size بتاع الـ array باقي الـ elements ← هيخلي قيمتهم بـ 0

* Multi-Dimensional Array

- have two or more index values

exp:- img[i][j]

specify row index ← → specify column index.

- 2D Array are stored in memory by row.

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- 1D & 2D Array ⟶ work hand in hand with for loops

- 2D Array ⟶ work with nested loop.

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Strings

- Initializing a string can be done in 3 ways :-

1- at declration

```
char name[10] = {"Ahmed"}
```

OR

```
char name[10] = {"S", "e", "i", "f", "\0"}
```

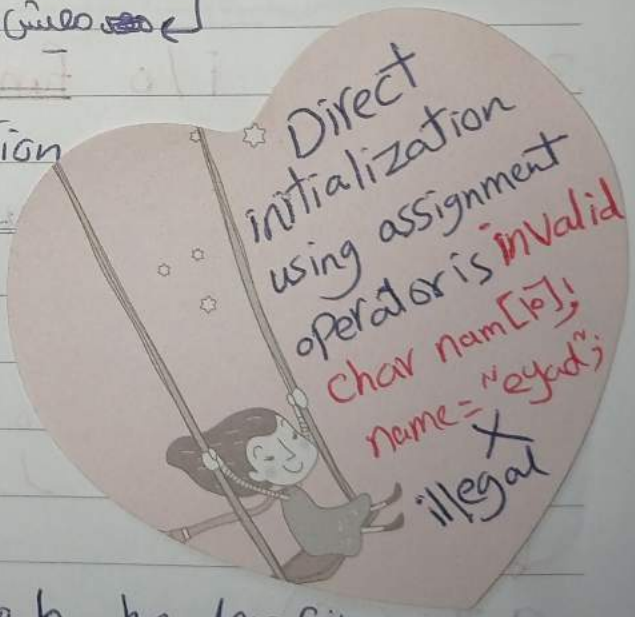
↳ null operator يوقف قراءة كده.

2- By reading a value.

```
scanf ("%s", name);
```

↳ مفيش معاها &

3- using strcpy function



String functions

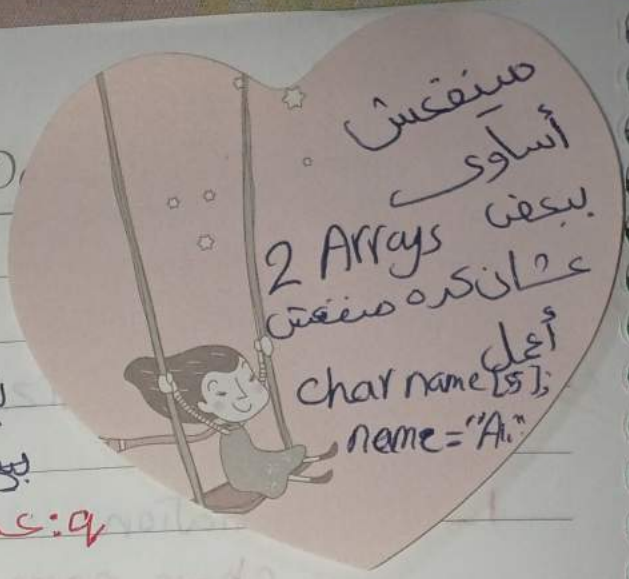
1- strcpy (S_1, S_2)

should include string.h header file

```
#include <string.h>
```

- S_2 will copied into S_1 هيتخزن في S_1

بس S_2 هيفضل زي ما هو عادي



2- Strcat(s)

بتعمل concatination
بمعنى بيزود على ال s string اللي عندي

ق: عملتوا ليه ق ليه مستخدمتش Strcpy ؟

Ans: عشان لو عملت Strcpy مرتين وزا بعض هيعمل overrides على القيمة الموجودة ومسحها ويفضل الجديدة بس عشان كده استخدمت Strcat عشان لو عايزة ازود على string موجود أزود عادي.

3- String i/o functions :-

- Limitation of using scanf to read in strings is that input string can't contain spaces.

special i/o functions عشان كده

gets(s)
- reading in a string from keyboard
- built in جواها → i/o

puts( )
- display a string
مقدرش اكتب جواها printf زي const string

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4- Strlen (Array name)

* بترجعلي عدد الـ characters مش عدد الأماكن المحجوزة

5- strcmp (s_1, s_2)

- Compare two strings By ASCII Code.

بيقارن كل char بالتاني

6- strcmpi (s_1, s_2) i → ignore

- ignore key ⟵ يعني ايه؟ ⟵

يعني مبيفرقش بين الكابيتل والاسمول بيعتبرهم حاجة واحدة.

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struct (Structure)

- user defined data type that can be used to group items of possibly diffrent data type into a single type.
- items in struct are called members

- we have to declare struct in the begining of the program && before main function.

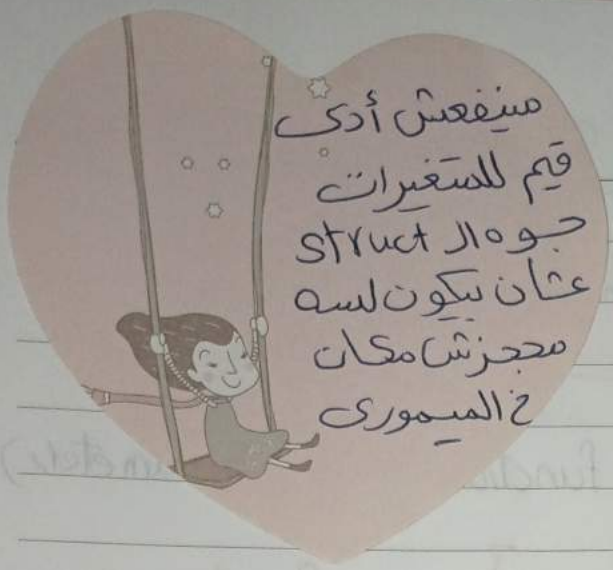
struct name{ ← type declration
    data type member1 ; ← not variable declration
}

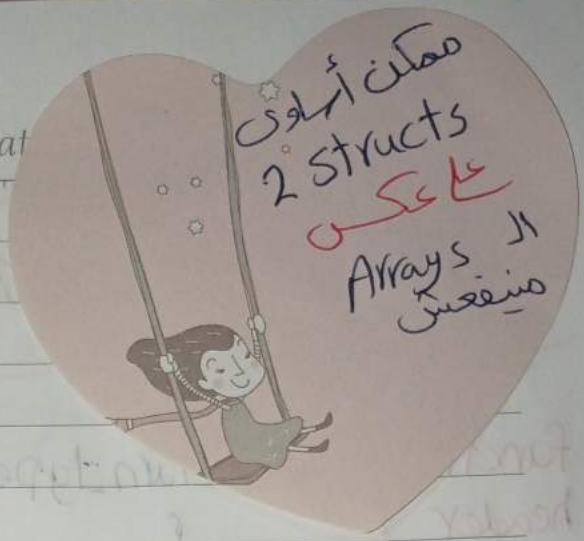
هو يعتبر تعريف لنوع من البيانات struct ← data type

مجرد ما نعمل declare ما بنحجز مكان في الميموري
الميموري لسه ما أعرفت متغير ← هيحجز مكان في الميموري

- to declare a structure variable,
  struct name Varname;

- we use dot notation (.) to access a member.





ينفع أعمل Variable من النوع
array عادى
array of structs هيبقى

ومن أى نوع عادى

* Structes can have Structes members.

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user defined functions

function header / prototype ← return_type function_name (parameters)

```
{
    // code
}
```

→ function body.

return_type

- void
- returned_type → must have return statement and must match returned type.

- When function is declared ~~before~~ after main function → we must put the prototype function before main function.

- the number & type of actual arguments in function reference must match the number & type of dummy arguments in function definition.

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- Any changes made to a dummy argument inside function will not affect the actual argument in the main program.