

# C Course

## Outlines :-

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

## Introduction to C

\* Programming : 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, Development, testing, Development, maintenance.

Date:

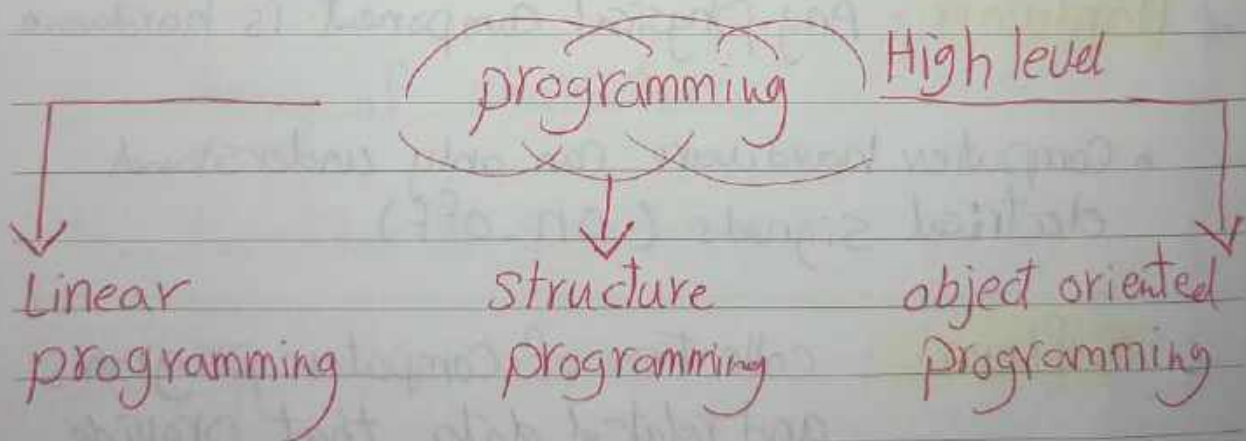
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## \* Testing :

- unit test
- Functional test
- performance test
- Stress test
- User Acceptance test.

## \* Deployment :

- Direct
- parallel
- phase



## 1. Linear programming :

بيبدأ من أول سطر  
فإنه يتنقل التوام إلى أن يكتفيها لوعاية أرفع ل  
Statement يرجع إلى كتيبات



## 2. Structure programming :

يبدأ أرن من ال main function  
 يأخذ الكود المكتروأدخله في block الذي هو (function)  
 كل function يبقى فيها مجموعة من ال Statements

\* لازم أراي ال maintenance

\* الكود الذي هو :- \*

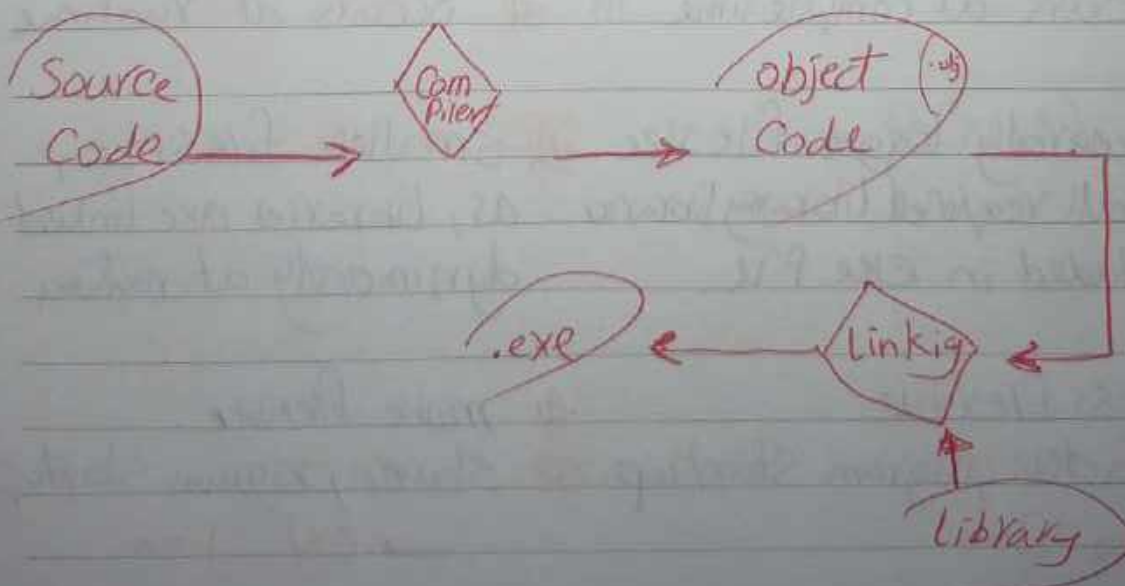
أراي الخ لما أراجع بعد

\* سنة مثلك أعدله في ال

Statements يبقى الموضوع سهل \*

وده الذي خلاهم طوو وواصت PL

لدينا من ال linear الحدا ال oop



## Linking

### Static

### Dynamic

\* executable file include the library inside itself  
 البرنامج مش محتاج يزل الوقت ويرضاه

\* process of linking external libraries & references at runtime when the program is loaded or executed.

\* Process of combining all necessary libraries and external references into a single executable file at compile time.

\* occurs at compile time

\* occurs at runtime

\* Generally larger file size so, all required library libraries included in exe file.

\* smaller file size, as, libraries are linked dynamically at runtime

\* Less flexible

\* more flexible.

\* Faster program startup

\* slower program startup

→ C

→ C#, java



Notes

- 1 byte = 8 bit.
- 1 byte (not signed) Range  $\rightarrow$   
( $0 \rightarrow 2^8 - 1$ ).

- 1 byte (signed)  $\rightarrow$   $0 \rightarrow 2^7 - 1$   
(1 bit for sign)  $-1 \rightarrow -2^7$

- Binary system  $\rightarrow$  (0, 1)

- الكهرباء يتدخل الكمبيوتر على هيئة 0, 5 Volt  
عشان كده الكمبيوتر ميفهمش إلا 0, 1 واختصاره ان لو  
فيه توكرا هتبقى 1 ولو مفيش يبقى 0.

- floating data  $\rightarrow m * 10^n$

- Decimaal system <sup>range</sup>  $\rightarrow$  ( $0 \rightarrow 10^n - 1$ )

## Why C

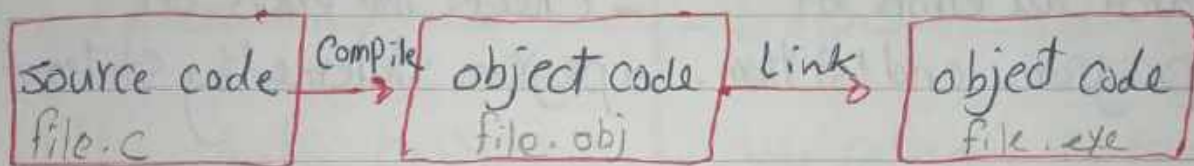
- C is a widely used portable high level programming.
- Mid level language.
- Compact, fast and powerful.
- C is the native language of Unix.
- Many languages have a pedigree (đôi)
- used for embedded programming.

## C history

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



## C program Life cycle



## IDEN

### 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.



## Compiler

- Search all errors of a program and list them.

- Compiler takes entire program as input

- intermediate object code is generated.

- program need not be compiled every time.

- Errors are displayed after entire program is checked

C, C++

## interpreter

- check the errors of a program statement by statement.

- Interpreter takes single instruction as input.

- ~~No~~ intermediate object code is generated

- every time higher level program is converted into low level.

- Errors are displayed for every instruction interpreted.

Basic.

## Static Linking

- Extension .lib
- The data copied on every executable file.
- The executable file run without need of the library file.

## Dynamic Linking

- Extension .dll
- Only reference to the library on the executable file.
- Executable file need library to run.

## Errors

- Syntax error
- Logical error (runtime)
- Warning



## 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.

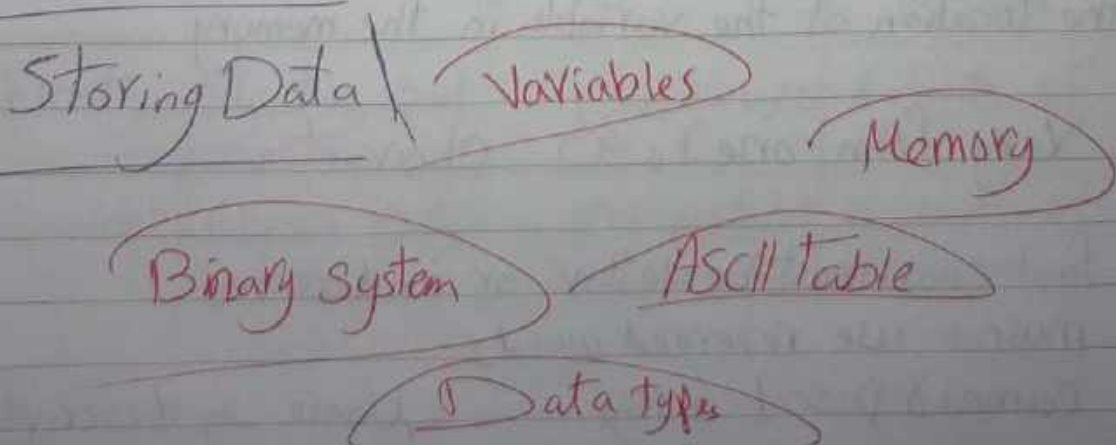
## Header files

- 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.

- 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`.





## 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.
- mustn't use reserved words.
- camel & Pascal casing
- Name  $\rightarrow$  descriptive

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

## Memory

## Data types

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

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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

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

scanf ( control string , address list )

←  
format specifier

↓  
Specify memory location of variable

& → address operator

Some of functions

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

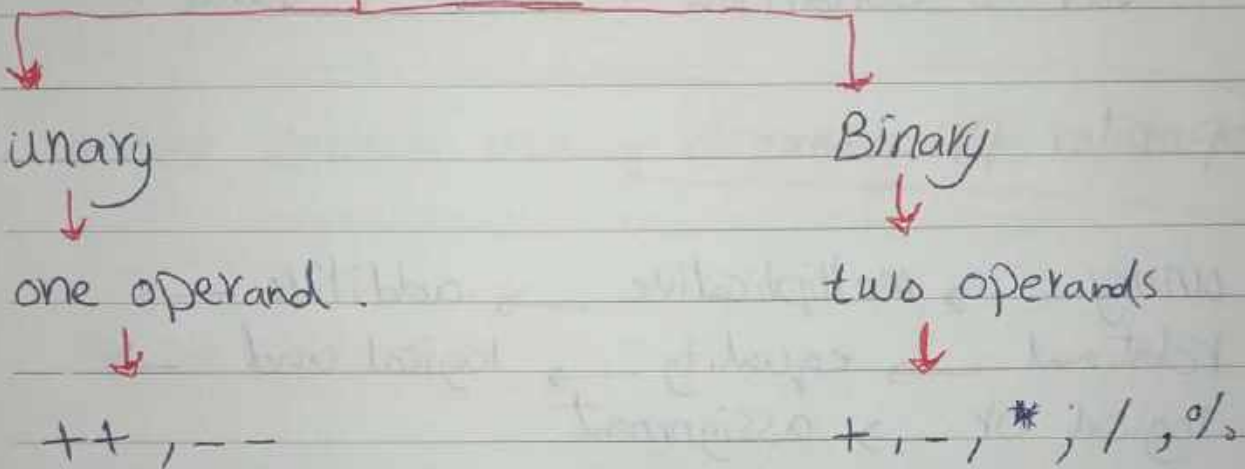
→ clrscr() : Conio.h  
• clear the screen

→ gotoxy ( x, y ) : Conio.h  
• move the cursor position



# operators

## 1. Arithmetic operators



## 2. Assignment operators

assign from right to left.

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

## 3. Relational operators

return 0, 1

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

## 4. Logical operators

! , && , ||

## 5. Bitwise operators :

&, |, ^ ; << shift left, ~ complement

## 6. Ternary operator (conditional operator)

Var = Condition ? Value 1 : 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.



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

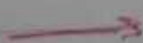
### if Statement

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 مراتب التكرار معروف

(while)



check على الحاجة وعدد مراتب التكرار غير معروف

(do while)



على الأقل تنفيذ مرة واحدة وعدد مراتب التكرار غير معروف

## prefix & postfix

بمسألة القيمة من تتغير على ال operand نتائجها ،  
تتغير بس في أي operation تانية

مثلا :-

$$x = 10;$$

$$y = x++;$$



عشان  $x$  جاية الأول  
فيخلو ال  $x$  بنفس القيمة  
بتأخر من غير ما يزداد  
وبعدين في هيزود واحد عليها

يعني :-

$$y = x++ \quad (x \text{ هنا بس})$$

$$x = x + 1$$

$$y = 10$$

$$x = 11$$

طب  $x$  زادت واحد ليه

عشان لما يزداد بخزن القيمة  
في  $x$  مش مجرد نقل القيمة  
وفلاصه لأن  $x++ = x + 1$

$$x = 10;$$

$$y = ++x;$$



عشان  $++$  جاية الأول وفييزود  
على  $x$  الأول وبعدين نقل الحاجة  
اللى بغير كده

يعني :-

$$x = x + 1$$

$$y = ++x \quad (x + 1)$$

$$y = 11$$

$$x = 11$$

طب  $x$  زادت واحد ليه

برهنوزي التانية عشان لما يزداد  
بخزن القيمة في  $x$  مش مجرد نقل  
القيمة وفلاصه لأن  $++x = x + 1$

وقصة ال  $x$  في الاثنين بتأكد في على اللى قولته فوق ان القيمة  
من تتغير على ال  $operand$  نفسه اللى هو  $x$



\* Magic box :-

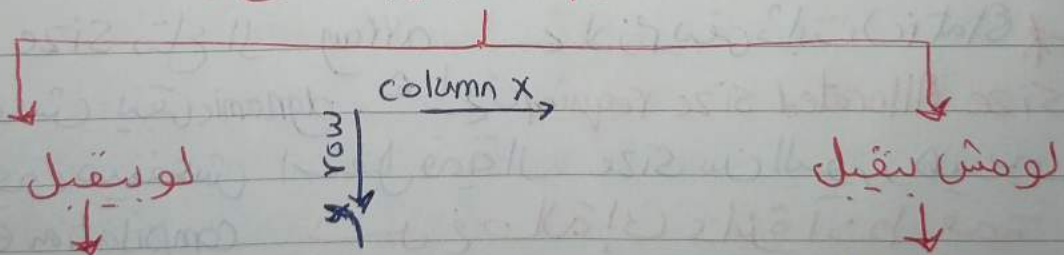
عبارة عن box يَحَقِّقُ أن مجموع كل صف = مجموع كل عمود = مجموع القل = 15

فمن نأبى دموا rules معينة أن اعلمكده من ههنا ال rules دى :-

الرقم الذي لازم يدخله لازم يبقى odd الذي هو ال size بتاع ال matrix يعني مثلاً  $3 \times 3$

في أول صف  $row = 1$   
والهوية  $column = \frac{Size}{2} + 1$

الرقم الى قبله يفتيل القصة <sup>Size</sup> الى Case 2



Row 11 2920

row 11 ~~10~~ 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 1040 1041 1042 1

Column بقدر 1 (فقط Column) کش هر دو معنی  
 جلب هتدله ی Screen از ای ؟ ← عن طریق (column row) gotoxy

## 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.

\* Size of array ← لازم يبق ثابت (Static)

Size Allocated size required ~~هيا بيق~~ dynamic

يعني مينفعش استعمل قبة ال size من الينوز هيريني

Compilation error ~~بس في حالة اني عاليزه اخط قبة~~

ال size في variable ~~أقدر اعمله عن طريق~~

# define size 3   
 int id[size];

في الأول



- \* During declaration consecutive memory locations are reserved for the array and all its elements.

يعني يحتجز الأماكن المتتالية في الذاكرة لكل element وبنفس

- \* After declaration, you can't assume that the elements have been initialized by zero.

يعني متفترض ان تكون 0

```
int id[5];
```

```
id[5] = {4, 1, 3, 2, 5};
```

- \* لو ال initial elements أقل من ال size بتاع ال array  
بائع ال elements ← يخطئ قاعده 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.

1D & 2D Array → work hand  
in hand with for loops

2D Array → work with nested loop



## Strings

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

1. at declaration

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

OR `char name[10] = {'s', 'e', 'i', 'f', '\0'};`

Null operator  $\leftarrow$  بوقف قراة عندہ

2. By reading a value.

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

سے پڑھو

3. using strcpy function

## String functions

1. `strcpy(s1, s2)`

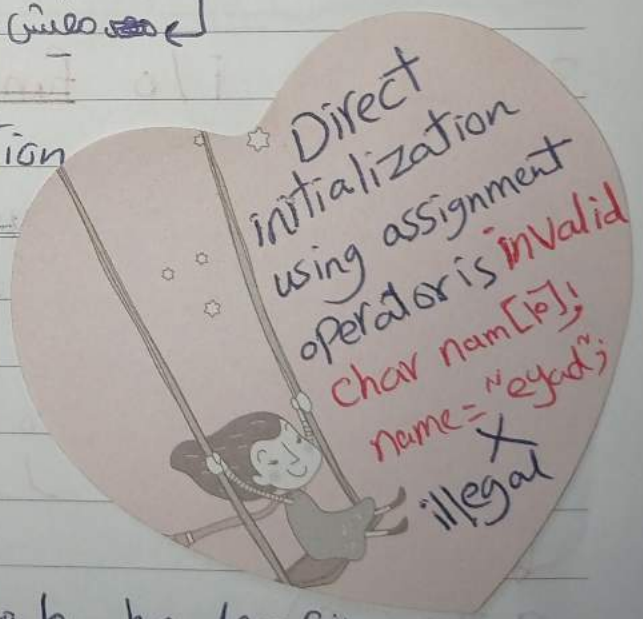
should include string.h header file

`#include <string.h>`

- s2 will copied into s1

س2 کی کپی س1 میں ہوگی

س1 میں محفوظ ہوگی



## 2- strcat(s)

Concatination

يتميز بزيادة string s

عملتها لـ q: ليه مسافة

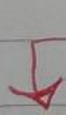
strcpy?

Ans: عملتها لـ strcpy موش ورا بعت هيل  
overridden على القيمة الموجودة ولمسحها وبفضل الجدية  
عشان كده استغنى عن strcat عشان لو انا زود على string  
موجود ازود عادي.

## 3. String i/o functions :-

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

عشان كده special i/o functions



gets(s)

- reading in a string from keyboard

- builtin  $\rightarrow$  /o



puts()

- display a string

مقدرش الت بول

printf  $\rightarrow$  const string



4- `Strlen (Array name)`

• بترجلی عدد از characters من عدد اتمات الحوزة

5- `strcmp (s1, s2)`

- Compare two strings By ASCII Code.  
بمقارن كل char بالتاتي

6- `strcmpi (s1, s2)`

i → ignore

- ignore key → يعني ايه →

يعني مبيفرقش بين الاكاسيل والاحمول بيجزهم صاحة واسبة

struct

(Structure)

- user defined data type that can be used to group items of possibly different data type into a single type.

- items in struct are called **members**.

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

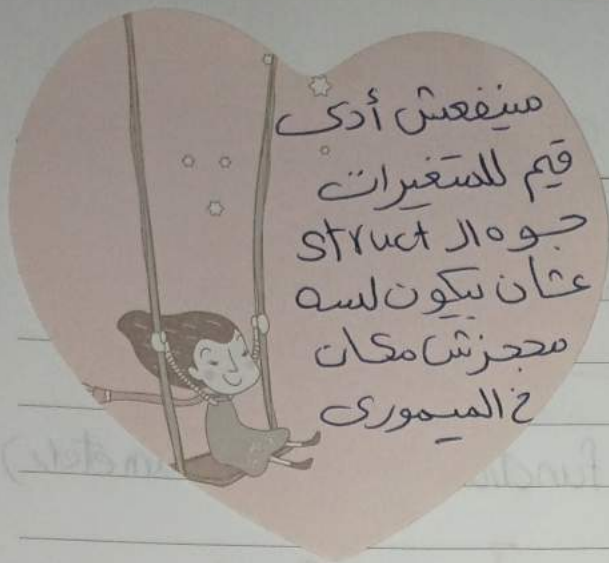
$\text{struct name} \{$  ← type declaration  
 $\text{data type member} \}$  ← not variable declaration  
 ← data type  
 ← struct

مجرد ماربلة declare → معجزه في مكانه  
 المصور لسه ← معجزه مكانه المصور  
 لا أعرف معجزه

- to declare a structure variable,  
 $\text{struct name varname};$

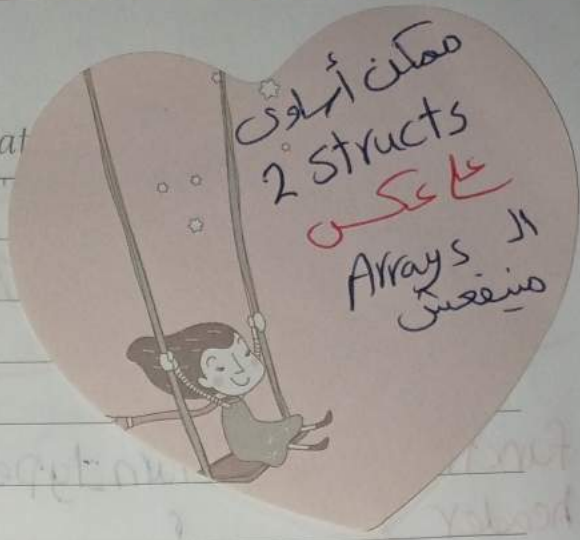
- we use dot notation (.) to access a member.





منفعش أدب  
قيم للمغيرات  
جوه ال struct  
عشان يكون لسه  
محجزش مكان  
خ الميموري

Date



ممكن أهدوي  
2 structs  
عكس  
ال Arrays  
منفعش

ومن أي  
نوع عادي

ينفع أء ل variable من النوع  
عادي array  
هيقى array of structs

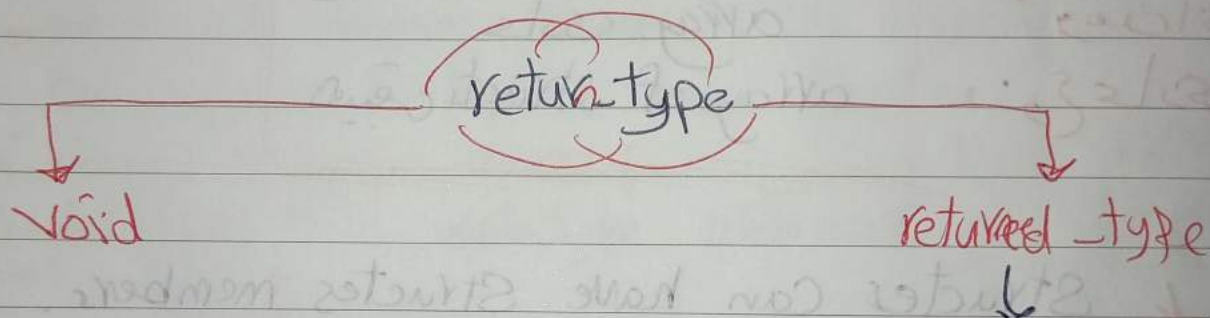
\* Structures can have structures members.

## user defined functions

function header / prototype

```
return_type function_name(parameters) {  
    // code  
}
```

function body.



must have **return statement**  
and must match **returned**  
**type**.

- When function is declared ~~before~~ after main function  $\rightarrow$  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.



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