# Programming Fundamentals

Dr. Abdul Aziz

Assistant Professor & HoD

Department of Software Engineering

NUCES-FAST, Karachi.

# Elements of a language

- Character Set: Alphabets
- Grammar: The rules of language
- Sentences: Meaningful element created with the help of Characters and Grammar.

# Elements of Computer Language

- Character Set
- Keywords
- Data Types
- Syntax

# Character Set

- ASCII - American Standard Code for Information Interchange
- Standard data-encoding format for electronic communication between computers.
- ASCII assigns standard numeric values to letters, numerals, punctuation marks, and other characters used in computers

| Control Characters | | | | Graphic Symbols | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | Dec | Binary | Hex | Symbol | Dec | Binary | Hex | Symbol | Dec | Binary | Hex | Symbol | Dec | Binary | Hex |
| NUL | 0 | 0000000 | 00 | space | 32 | 0100000 | 20 | @ | 64 | 1000000 | 40 | ` | 96 | 1100000 | 60 |
| SOH | 1 | 0000001 | 01 | ! | 33 | 0100001 | 21 | A | 65 | 1000001 | 41 | a | 97 | 1100001 | 61 |
| STX | 2 | 0000010 | 02 | " | 34 | 0100010 | 22 | B | 66 | 1000010 | 42 | b | 98 | 1100010 | 62 |
| ETX | 3 | 0000011 | 03 | # | 35 | 0100011 | 23 | C | 67 | 1000011 | 43 | c | 99 | 1100011 | 63 |
| EOT | 4 | 0000100 | 04 | $ | 36 | 0100100 | 24 | D | 68 | 1000100 | 44 | d | 100 | 1100100 | 64 |
| ENQ | 5 | 0000101 | 05 | % | 37 | 0100101 | 25 | E | 69 | 1000101 | 45 | e | 101 | 1100101 | 65 |
| ACK | 6 | 0000110 | 06 | & | 38 | 0100110 | 26 | F | 70 | 1000110 | 46 | f | 102 | 1100110 | 66 |
| BEL | 7 | 0000111 | 07 | ' | 39 | 0100111 | 27 | G | 71 | 1000111 | 47 | g | 103 | 1100111 | 67 |
| BS | 8 | 0001000 | 08 | ( | 40 | 0101000 | 28 | H | 72 | 1001000 | 48 | h | 104 | 1101000 | 68 |
| HT | 9 | 0001001 | 09 | ) | 41 | 0101001 | 29 | I | 73 | 1001001 | 49 | i | 105 | 1101001 | 69 |
| LF | 10 | 0001010 | 0A | * | 42 | 0101010 | 2A | J | 74 | 1001010 | 4A | j | 106 | 1101010 | 6A |
| VT | 11 | 0001011 | 0B | + | 43 | 0101011 | 2B | K | 75 | 1001011 | 4B | k | 107 | 1101011 | 6B |
| FF | 12 | 0001100 | 0C | , | 44 | 0101100 | 2C | L | 76 | 1001100 | 4C | l | 108 | 1101100 | 6C |
| CR | 13 | 0001101 | 0D | − | 45 | 0101101 | 2D | M | 77 | 1001101 | 4D | m | 109 | 1101101 | 6D |
| SO | 14 | 0001110 | 0E | . | 46 | 0101110 | 2E | N | 78 | 1001110 | 4E | n | 110 | 1101110 | 6E |
| SI | 15 | 0001111 | 0F | / | 47 | 0101111 | 2F | O | 79 | 1001111 | 4F | o | 111 | 1101111 | 6F |
| DLE | 16 | 0010000 | 10 | 0 | 48 | 0110000 | 30 | P | 80 | 1010000 | 50 | p | 112 | 1110000 | 70 |
| DC1 | 17 | 0010001 | 11 | 1 | 49 | 0110001 | 31 | Q | 81 | 1010001 | 51 | q | 113 | 1110001 | 71 |
| DC2 | 18 | 0010010 | 12 | 2 | 50 | 0110010 | 32 | R | 82 | 1010010 | 52 | r | 114 | 1110010 | 72 |
| DC3 | 19 | 0010011 | 13 | 3 | 51 | 0110011 | 33 | S | 83 | 1010011 | 53 | s | 115 | 1110011 | 73 |
| DC4 | 20 | 0010100 | 14 | 4 | 52 | 0110100 | 34 | T | 84 | 1010100 | 54 | t | 116 | 1110100 | 74 |
| NAK | 21 | 0010101 | 15 | 5 | 53 | 0110101 | 35 | U | 85 | 1010101 | 55 | u | 117 | 1110101 | 75 |
| SYN | 22 | 0010110 | 16 | 6 | 54 | 0110110 | 36 | V | 86 | 1010110 | 56 | v | 118 | 1110110 | 76 |
| ETB | 23 | 0010111 | 17 | 7 | 55 | 0110111 | 37 | W | 87 | 1010111 | 57 | w | 119 | 1110111 | 77 |
| CAN | 24 | 0011000 | 18 | 8 | 56 | 0111000 | 38 | X | 88 | 1011000 | 58 | x | 120 | 1111000 | 78 |
| EM | 25 | 0011001 | 19 | 9 | 57 | 0111001 | 39 | Y | 89 | 1011001 | 59 | y | 121 | 1111001 | 79 |
| SUB | 26 | 0011010 | 1A | : | 58 | 0111010 | 3A | Z | 90 | 1011010 | 5A | z | 122 | 1111010 | 7A |
| ESC | 27 | 0011011 | 1B | ; | 59 | 0111011 | 3B | [ | 91 | 1011011 | 5B | { | 123 | 1111011 | 7B |
| FS | 28 | 0011100 | 1C | < | 60 | 0111100 | 3C | \ | 92 | 1011100 | 5C | \| | 124 | 1111100 | 7C |
| GS | 29 | 0011101 | 1D | = | 61 | 0111101 | 3D | ] | 93 | 1011101 | 5D | } | 125 | 1111101 | 7D |
| RS | 30 | 0011110 | 1E | > | 62 | 0111110 | 3E | ^ | 94 | 1011110 | 5E | ~ | 126 | 1111110 | 7E |
| US | 31 | 0011111 | 1F | ? | 63 | 0111111 | 3F | _ | 95 | 1011111 | 5F | Del | 127 | 1111111 | 7F |

# Keywords

- Reserved words used in programming that have special meanings to the compiler.
- They are 32 keywords.

| | | | |
|---|---|---|---|
| auto | break | case | char |
| const | continue | default | do |
| double | else | enum | extern |
| float | for | goto | if |
| int | long | register | return |
| short | signed | sizeof | static |
| struct | switch | typedef | union |
| unsigned | void | volatile | while |

# Data Types

- Used to define variables.
- Variables are define as "A temporary memory space to store data, and have a name for easy reference".
- If every thing is in binary then why data types?

| Type | Size (bytes) | Format Specifier |
| --- | --- | --- |
| `int` | at least 2, usually 4 | `%d`, `%i` |
| `char` | 1 | `%c` |
| `float` | 4 | `%f` |
| `double` | 8 | `%lf` |
| `short int` | 2 usually | `%hd` |
| `unsigned int` | at least 2, usually 4 | `%u` |
| `long int` | at least 4, usually 8 | `%ld`, `%li` |
| `long long int` | at least 8 | `%lld`, `%lli` |
| `unsigned long int` | at least 4 | `%lu` |
| `unsigned long long int` | at least 8 | `%llu` |
| `signed char` | 1 | `%c` |
| `unsigned char` | 1 | `%c` |
| `long double` | at least 10, usually 12 or 16 | `%Lf` |

# Syntax

- Grammar .
- How a specific task in done in a language.

# Using a variable

- Syntax:
- Datatype  Name ;
  - OR

  Datatype Name = Value;
- Example:

| | |
|---|---|
| int var; | int var =0; |
| char ch; | char ch='A'; |
| float f1; | float f1= 10.5; |

# Reading a Value from User/Keyboard

- SCANF
- Syntax:

**scanf(“format specifier”, address of the variable);**

- Example:
- int a=0;
- scanf(“%d”, &a);

# Escape Sequence

- The purpose of the escape sequence is to represent the characters that cannot be used normally using the keyboard

| Escape Sequence | Name | Description |
|---|---|---|
| \a | Alarm or Beep | It is used to generate a bell sound in the C program. |
| \b | Backspace | It is used to move the cursor one place backward. |
| \f | Form Feed | It is used to move the cursor to the start of the next logical page. |
| \n | New Line | It moves the cursor to the start of the next line. |
| \r | Carriage Return | It moves the cursor to the start of the current line. |
| \t | Horizontal Tab | It inserts some whitespace to the left of the cursor and moves the cursor accordingly. |
| \v | Vertical Tab | It is used to insert vertical space. |
| \\ | Backlash | Use to insert backslash character. |
| \' | Single Quote | It is used to display a single quotation mark. |
| \" | Double Quote | It is used to display double quotation marks. |
| \? | Question Mark | It is used to display a question mark. |
| \ooo | Octal Number | It is used to represent an octal number. |
| \xhh | Hexadecimal Number | It represents the hexadecimal number. |
| \0 | NULL | It represents the NULL character. |