Tshwane University of Technology

We empower people

INSTRUCTIONS TO CANDIDATES

1. All exam rules stated by the Tshwane University of Technology apply.
2. **Ensure a single final version of your source code is handed in as requested.**
3. If needed, state all necessary assumptions clearly in code commentary.

MARKS: 100%

PAGES: 15 (incl. cover)

EXAMINER:

Mr A.J. Smith

Prof J.A. Jordaan

MODERATOR:

Mr TE Olivier

TIME:

90 Minutes

(30 minutes extra time)

FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT

DEPARTMENT OF ELECTRICAL ENGINEERING

ES216BB ENGINEERING SOFTWARE DESIGN B

EVALUATION 2

October 2025

EVALUATION INSTRUCTIONS

1. **Plagiarism:** Submit only original work. We will use similarity software to verify the authenticity of all submissions.

2. **Permitted Tools:** You are allowed to use only **CodeBlocks** and **Google Chrome** to access the evaluation, view the evaluation PDF and upload your submission for this evaluation. Access to emails, other online resources, and memory sticks is strictly prohibited. Please be aware that computer activity will be remotely monitored. Breaches of TUT's official examination and module rules will result in a minimum penalty of zero for this evaluation, with the potential for further disciplinary action.

3. **File Submission:** Your source code file must be named according to this format: **"<student number>.cpp" (e.g. 21011022.cpp).** Do not add any other text (name, surname, etc.) to the file name (ONLY YOUR STUDENT NUMBER).

4. **Uploading Instructions:** Submit your ".cpp" file via the designated upload link. While multiple uploads are allowed, only the most recent submission will be retained on the system. If you make an error in your initial upload, simply re-upload your file, and the previous version will be overridden.

5. **Evaluation Scope:** This assessment encompasses basic content from ES216AB and specifically ES216BB content defined in **Units 1 to 4**

6. **Programming Language:** Construct your program in **C++** and adhere to structured programming principles.

7. **Editing and Requirements:** Your program must meet all specified requirements. Refer to the attached appendices for additional details.

8. **Evaluation Requirements:**

   a. Remember to save your work on the PC "D: Drive" and save regularly throughout the evaluation.
   b. Do not modify the given code in the template ".cpp" file except for implementing the requested functions as required.
   c. Use the exact function names and parameters as used in the evaluation question paper and template ".cpp" file.
   d. Complete the C++ functions below the main function in each comment block as shown.

C++ FILE CODE EXPLANATION

You will be provided with a C++ file, which contains a partially completed program that manages a linked list structure to store athlete performance data. Your task is to implement the missing functions as described below.

The main function sets up a menu system that allows the user to perform the following tasks:

- Read data from a text file (AthleteData.txt) and populate the linked list.
- Display the linked list data in a tabular format.
- Display the athletes' performance along with deviations from the average score.
- Display a simple performance graph using stars (*), where each star represents 5 performance points.
- Delete all nodes in the linked list and exit the program.

The provided code contains the aNode structure to store athlete data, including athlete name, event, score, and adjustment factor. The linked list is dynamically managed, and memory is allocated or deallocated as needed. You will be required to implement the missing functions as detailed below.

FUNCTIONS IMPLEMENTATION

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1. Populate Node Function

void aNode::PopulateNode (string aName, string event, float score, float adjFactor);

- **Purpose**: Initialises an athlete node with the provided athlete data.
- **Parameters**:
  - *aName*: Athlete's name (string).
  - *event*: Event name (string).
  - *score*: Original performance score obtained by the athlete (float).
  - *adjFactor*: Adjustment factor used to normalise or modify the athlete's score based on specific conditions (float).
- **Return**:
  - No return value.

---

2. Calculate Adjusted Score Function

float aNode::AdjustedScore (void);

- **Purpose**: Calculates the athlete's adjusted performance score by applying the adjustment factor.
- **Parameters**:
  - No parameters, as it uses internal structure variables.
- **Return**:
  - Returns the adjusted score as a float.

---

3. Read File and Populate Function

void ReadFileAndPopulate (string FileName, aNode **sPtr);

- **Purpose**: Reads athlete data from a file and populates a linked list.
- **Parameters**:
  - *FileName*: Name of the file containing athlete data (string).
  - *sPtr*: Pointer to the head pointer of the linked list (aNode**).
- **Return**:
  - No return value.

---

4. Insert Node Function

void InsertNode (aNode **sPtr, string aName, string event, float score, float adjFactor);

- **Purpose**: Creates and inserts a new athlete node at the end of the linked list.
- **Parameters**:
  - *sPtr*: Pointer to the head pointer of the linked list (aNode**).
  - *aName*: Athlete's name (string).
  - *event*: Event name (string).
  - *score*: Original performance score of the athlete (float).
  - *adjFactor*: Adjustment factor for score normalisation (float).
- **Return**:
  - No return value.

---

5. **Display Data Table Function**

void DisplayDataTable (aNode *sPtr);

- Purpose: Displays athlete data in tabular form.
- Parameters:
  - *sPtr*: Pointer to the head of the linked list (aNode*).
- Return:
  - No return value.

---

6. **Display Score and Deviation Table Function**

void DisplayScoreDeviationTable (aNode *sPtr);

- **Purpose**: Calculates and displays each athlete's adjusted score and its deviation from the average adjusted score.
- **Parameters**:
  - *sPtr*: Pointer to the head of the linked list (aNode*).
- **Return**:
  - No return value.

---

7. **Display Performance Graph Function**

void DisplayPerformanceGraph (aNode *sPtr);

- **Purpose**: Displays a graphical representation of each athlete's adjusted score.
- **Parameters**:
  - *sPtr*: Pointer to the head of the linked list (aNode*).
- **Return**:
  - No return value.

---

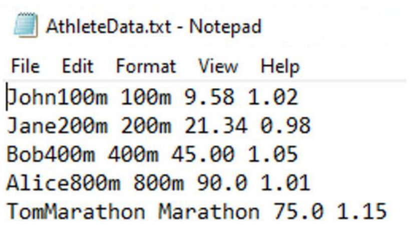
8. **Delete All Nodes Function**

void DeleteAllNodes (aNode **sPtr);

- **Purpose**: Deletes all nodes from the linked list to free memory and resets the head pointer to nullptr.
- **Parameters**:
  - *sPtr*: Pointer to the head pointer of the linked list (aNode**).
- **Return**:
  - No return value.

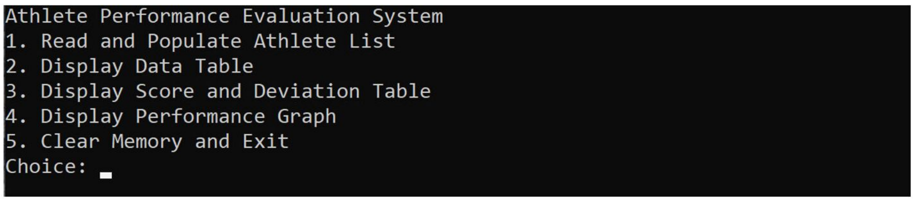
PRINT SCREENS

Text File Content:



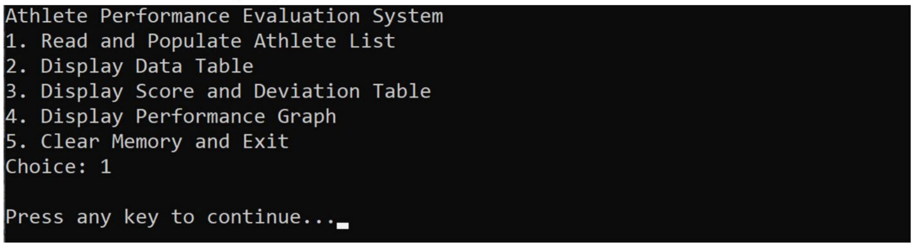
```
John100m 100m 9.58 1.02
Jane200m 200m 21.34 0.98
Bob400m 400m 45.00 1.05
Alice800m 800m 90.0 1.01
TomMarathon Marathon 75.0 1.15
```

Main Menu:



```
Athlete Performance Evaluation System
1. Read and Populate Athlete List
2. Display Data Table
3. Display Score and Deviation Table
4. Display Performance Graph
5. Clear Memory and Exit
Choice: 
```

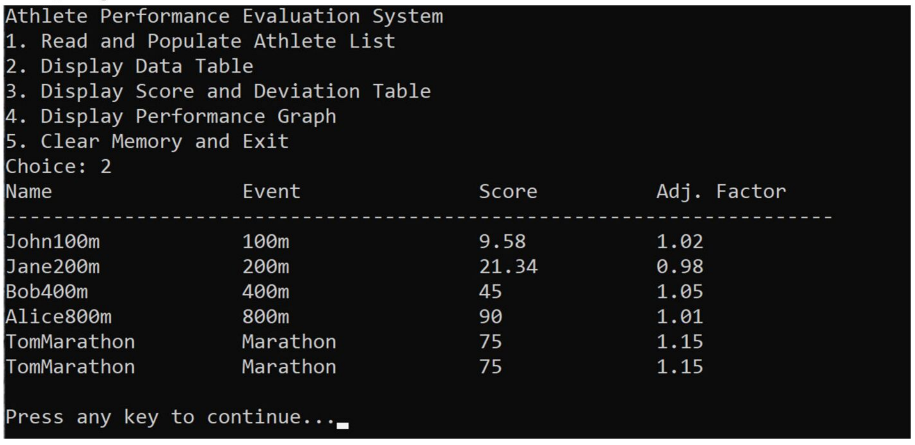
Read data and populate:



```
Athlete Performance Evaluation System
1. Read and Populate Athlete List
2. Display Data Table
3. Display Score and Deviation Table
4. Display Performance Graph
5. Clear Memory and Exit
Choice: 1

Press any key to continue...
```

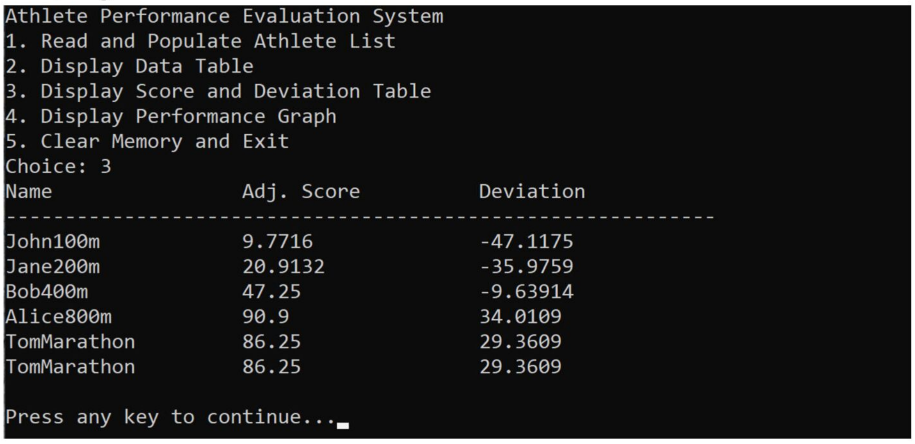
Display data table:



```
Athlete Performance Evaluation System
1. Read and Populate Athlete List
2. Display Data Table
3. Display Score and Deviation Table
4. Display Performance Graph
5. Clear Memory and Exit
Choice: 2
Name                Event               Score          Adj. Factor
----------------------------------------------------------------------
John100m            100m                9.58           1.02
Jane200m            200m                21.34          0.98
Bob400m             400m                45             1.05
Alice800m           800m                90             1.01
TomMarathon         Marathon            75             1.15
TomMarathon         Marathon            75             1.15

Press any key to continue...
```

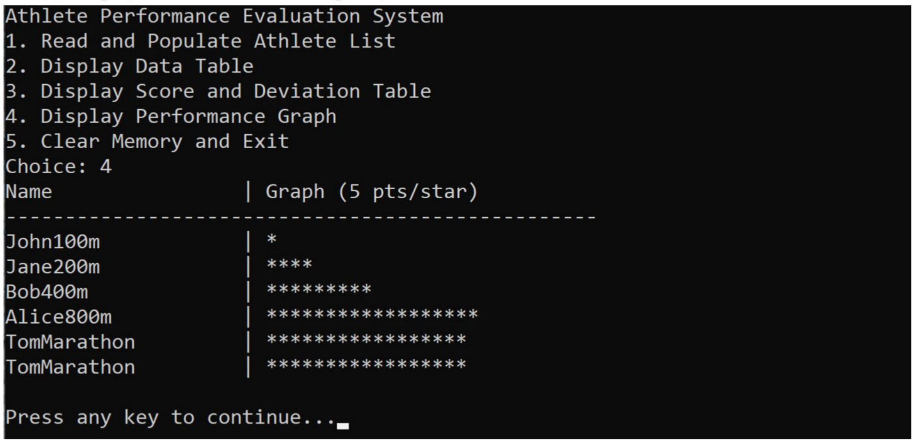
Display score and deviation table:



```
Athlete Performance Evaluation System
1. Read and Populate Athlete List
2. Display Data Table
3. Display Score and Deviation Table
4. Display Performance Graph
5. Clear Memory and Exit
Choice: 3
Name                Adj. Score          Deviation
------------------------------------------------------------
John100m            9.7716              -47.1175
Jane200m            20.9132             -35.9759
Bob400m             47.25               -9.63914
Alice800m           90.9                34.0109
TomMarathon         86.25               29.3609
TomMarathon         86.25               29.3609

Press any key to continue...
```

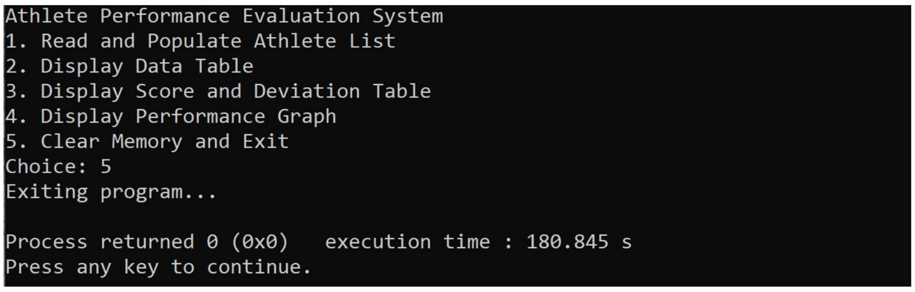
Display performance graph:



```
Athlete Performance Evaluation System
1. Read and Populate Athlete List
2. Display Data Table
3. Display Score and Deviation Table
4. Display Performance Graph
5. Clear Memory and Exit
Choice: 4
Name                | Graph (5 pts/star)
--------------------------------------------------
John100m            | *
Jane200m            | ****
Bob400m             | *********
Alice800m           | ******************
TomMarathon         | *****************
TomMarathon         | *****************

Press any key to continue...
```

Clear memory and exit:

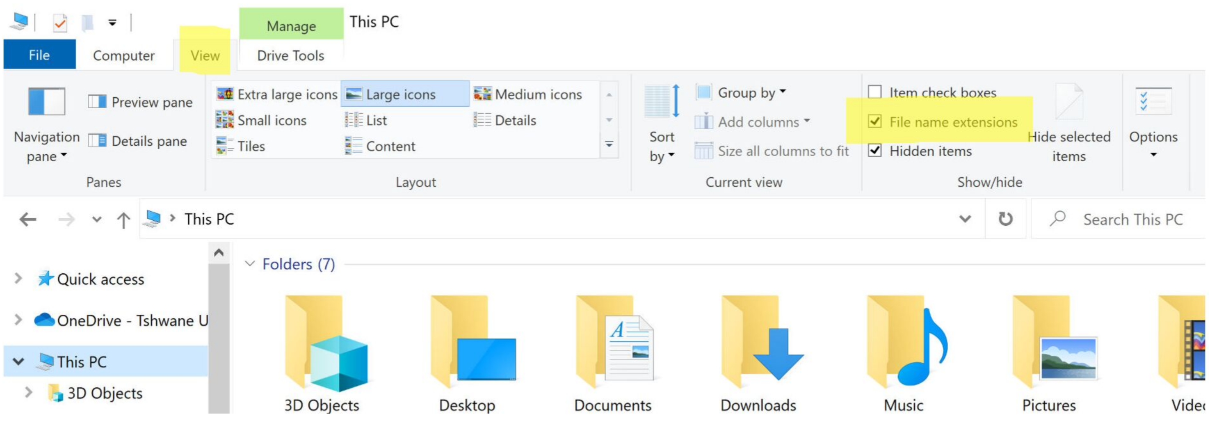


```
Athlete Performance Evaluation System
1. Read and Populate Athlete List
2. Display Data Table
3. Display Score and Deviation Table
4. Display Performance Graph
5. Clear Memory and Exit
Choice: 5
Exiting program...

Process returned 0 (0x0)   execution time : 180.845 s
Press any key to continue.
```

HOW TO RUN THE SHOWCASE FILE

1. Enable file extensions (see highlighted in yellow)

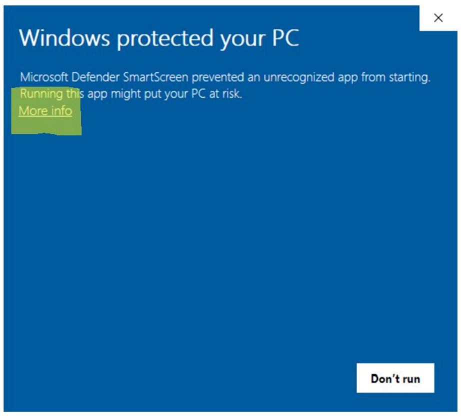


☐ Item check boxes
☑ File name extensions
☑ Hidden items

2. Change the name from **“Showcase.old”** to **“Showcase.exe”**

3. Run the **“ShowcaseEV.exe”** by double-clicking on the icon.

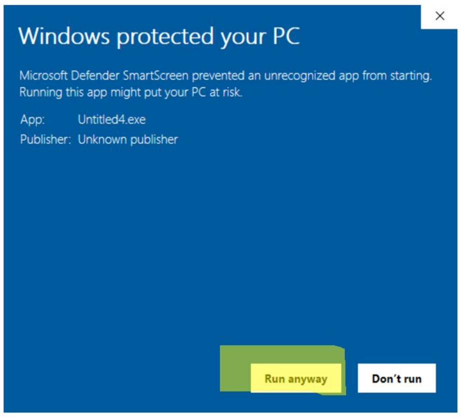
4. Windows may show the following. Click on **“More info”**



Windows protected your PC

Microsoft Defender SmartScreen prevented an unrecognized app from starting. Running this app might put your PC at risk.
More info

5. Click on **“Run anyway”**



Windows protected your PC

Microsoft Defender SmartScreen prevented an unrecognized app from starting. Running this app might put your PC at risk.

App: Untitled4.exe
Publisher: Unknown publisher

ANNEXURE A – MARK ALLOCATION

Note: Score range is 0 - 4 which is: 0-none, 1-poor, 2-average, 3-good, 4-excellent

TEST RUBRIC	SCORE [0-4]	WEIGHT [%]
C++ CODE EVALUATION		**50+2**
1. Populate Node Structure Member Function		**5**
2. Calculate Adjusted Score Structure Member Function		**5**
3. Read File And Populate Function		**5**
4. Insert Node Function		**7**
5. Display Data Table Function		**5**
6. Display Score and Deviation Table Function		**5**
7. Display Performance Graph Function		**7**
8. Delete All Nodes Function		**5**
9. Overall Impression		**4**
10. Compile or Runtime Stability		**4**
TOTAL		**50**

Graduate Attribute	GA Number	GA Score [0-5]
Application of scientific and engineering knowledge	GA2	3,6,7
Engineering methods, skills, tools, including information technology	GA5	1,2,4,8
Impact of Engineering Activity	GA7	5,6,7
Engineering Professionalism	GA10	9,10

ANNEXURE B – INFORMATION SHEET

Data types: void, char, short, int, float, double

Data Type modifiers: const, auto, static, unsigned, signed

Arithmetic operators: * / % + -

Relational operators: < <= > >= == !=

Assignment operator: = += -= *= /= %= &= ^= |= <<= >>=

Logic operators: && || !

Bitwise logic operators: & | ^ ~ << >>

Pointer operators: Derefernce: * Address: &

Control Structures:

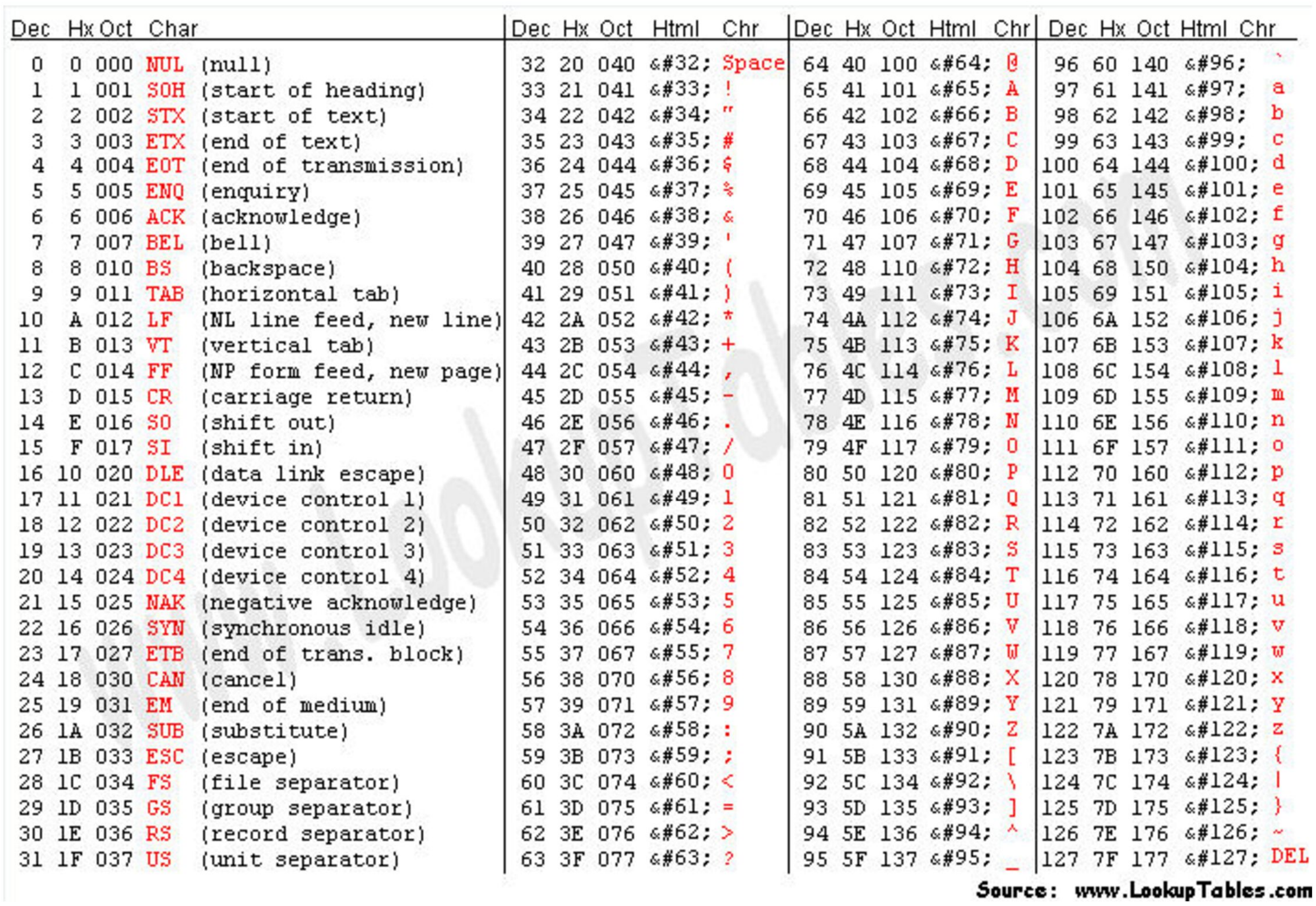
IF Selection:	if (condition) { … };
IF ELSE Selection:	if (condition) { … } else { … };
WHILE Loop:	while (condition) { … };
DO WHILE loop:	do { … } while (condition);
FOR Loop:	for (initial value of control variable; loop condition; increment of control variable) { … }
SWITCH Selection:	switch (control variable){ case ‘value’: … ; break; default: … ; break; }

Functions: return_data_type function_name (parameters) { … };

Arrays:

One dimensional:	data_type variable_name[size];
Two dimensional:	data_type variable_name [x_size][y_size];

ANNEXURE C – ASCII TABLE



Dec	Hx	Oct	Char	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr
0	0	000	NUL (null)	32	20	040	&#32;	Space	64	40	100	&#64;	@	96	60	140	&#96;	`
1	1	001	SOH (start of heading)	33	21	041	&#33;	!	65	41	101	&#65;	A	97	61	141	&#97;	a
2	2	002	STX (start of text)	34	22	042	&#34;	"	66	42	102	&#66;	B	98	62	142	&#98;	b
3	3	003	ETX (end of text)	35	23	043	&#35;	#	67	43	103	&#67;	C	99	63	143	&#99;	c
4	4	004	EOT (end of transmission)	36	24	044	&#36;	$	68	44	104	&#68;	D	100	64	144	&#100;	d
5	5	005	ENQ (enquiry)	37	25	045	&#37;	%	69	45	105	&#69;	E	101	65	145	&#101;	e
6	6	006	ACK (acknowledge)	38	26	046	&#38;	&	70	46	106	&#70;	F	102	66	146	&#102;	f
7	7	007	BEL (bell)	39	27	047	&#39;	'	71	47	107	&#71;	G	103	67	147	&#103;	g
8	8	010	BS (backspace)	40	28	050	&#40;	(	72	48	110	&#72;	H	104	68	150	&#104;	h
9	9	011	TAB (horizontal tab)	41	29	051	&#41;	)	73	49	111	&#73;	I	105	69	151	&#105;	i
10	A	012	LF (NL line feed, new line)	42	2A	052	&#42;	*	74	4A	112	&#74;	J	106	6A	152	&#106;	j
11	B	013	VT (vertical tab)	43	2B	053	&#43;	+	75	4B	113	&#75;	K	107	6B	153	&#107;	k
12	C	014	FF (NP form feed, new page)	44	2C	054	&#44;	,	76	4C	114	&#76;	L	108	6C	154	&#108;	l
13	D	015	CR (carriage return)	45	2D	055	&#45;	-	77	4D	115	&#77;	M	109	6D	155	&#109;	m
14	E	016	SO (shift out)	46	2E	056	&#46;	.	78	4E	116	&#78;	N	110	6E	156	&#110;	n
15	F	017	SI (shift in)	47	2F	057	&#47;	/	79	4F	117	&#79;	O	111	6F	157	&#111;	o
16	10	020	DLE (data link escape)	48	30	060	&#48;	0	80	50	120	&#80;	P	112	70	160	&#112;	p
17	11	021	DC1 (device control 1)	49	31	061	&#49;	1	81	51	121	&#81;	Q	113	71	161	&#113;	q
18	12	022	DC2 (device control 2)	50	32	062	&#50;	2	82	52	122	&#82;	R	114	72	162	&#114;	r
19	13	023	DC3 (device control 3)	51	33	063	&#51;	3	83	53	123	&#83;	S	115	73	163	&#115;	s
20	14	024	DC4 (device control 4)	52	34	064	&#52;	4	84	54	124	&#84;	T	116	74	164	&#116;	t
21	15	025	NAK (negative acknowledge)	53	35	065	&#53;	5	85	55	125	&#85;	U	117	75	165	&#117;	u
22	16	026	SYN (synchronous idle)	54	36	066	&#54;	6	86	56	126	&#86;	V	118	76	166	&#118;	v
23	17	027	ETB (end of trans. block)	55	37	067	&#55;	7	87	57	127	&#87;	W	119	77	167	&#119;	w
24	18	030	CAN (cancel)	56	38	070	&#56;	8	88	58	130	&#88;	X	120	78	170	&#120;	x
25	19	031	EM (end of medium)	57	39	071	&#57;	9	89	59	131	&#89;	Y	121	79	171	&#121;	y
26	1A	032	SUB (substitute)	58	3A	072	&#58;	:	90	5A	132	&#90;	Z	122	7A	172	&#122;	z
27	1B	033	ESC (escape)	59	3B	073	&#59;	;	91	5B	133	&#91;	[	123	7B	173	&#123;	{
28	1C	034	FS (file separator)	60	3C	074	&#60;	<	92	5C	134	&#92;	\	124	7C	174	&#124;	|
29	1D	035	GS (group separator)	61	3D	075	&#61;	=	93	5D	135	&#93;	]	125	7D	175	&#125;	}
30	1E	036	RS (record separator)	62	3E	076	&#62;	>	94	5E	136	&#94;	^	126	7E	176	&#126;	~
31	1F	037	US (unit separator)	63	3F	077	&#63;	?	95	5F	137	&#95;	_	127	7F	177	&#127;	DEL

Source: www.LookupTables.com