



M2 Arithmetic Expression and Solution

Mr. J. Mishra
MGCUB, INDIA

Objectives

Introduction

Operators
Precedences

ASCII Characters
and Number
System

Expressions
Solution

Exercise

References

Arithmetic Expression and Solution

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Outline

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Objectives

- Study arithmetic operators and its precedences
- Study on ASCII code and Number System
- Solve Arithmetic Expressions on C Compiler



Introduction

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- Operators are used to calculate any mathematical expression.
- Expressions could be sum of all kind of operators.
- Data type conversion also gives impulses to the expression.
- Function arguments also create some new values to expression.



Operators Precedences

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Table 1: Operators Precedences in C Language

Category	Operator	Associativity
Postfix	() [] -> . ++ --	Left to right
Unary	+ - ! ++ -- (type)* & sizeof	Right to left
Multiplicative	* /%	Left to right
Additive	+ -	Left to right
Shift	< >	Left to right
Relational	< <= > >=	Left to right
Equality	== !=	Left to right
Bitwise	AND &	Left to right
Bitwise	XOR	Left to right
Bitwise	OR	Left to right
Logical	AND &&	Left to right
Logical	OR	Left to right
Conditional	?:	Right to left
Assignment	= += -= *= /= %= »= «= &= ^= =	Right to left
Comma	,	Left to right



ASCII Characters and Number System

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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

Figure 1: ASCII Characters and Number System[1]



Expressions Solution[2],[3], [4],[5]

Example 1

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char data type variable with `+` operator adds ASCII value of two variables.

Example (Implicit Type Conversion)

```
1 #include <stdio.h>
2 int main()
3 {
4     int x;
5     char a='X', b='Y';
6     x = a + b;
7     printf("Value of x: %d", x);
8     return 0;
9 }
```

Output

Value of x: 177



Expressions Solution (Contd...)

Example 2

printf() returns length of string or variable and those are added is separated by commas.

Example (Returning value from *printf()*)

```
1 #include <stdio.h>
2 int main()
3 {
4     int x=5;
5     x = printf("\nValue of x: %d", x);
6     printf("\nValue of x: %d", x);
7
8     float y=3;
9     y = printf("\nValue of x: %f", y);
10    printf("\nValue of x: %f", y);
11
12    printf("\n");
13
14    // Temporary address of string
15    printf("%p\n", "Hello");
16
17    return 0;
18 }
```

Output

```
Value of x: 5
Value of x: 14
Value of x: 3.000000
Value of x: 21.000000
0x5622ac2e6024
```




Expressions Solution (Contd...)

Example 3

scanf() returns total number of inputs

Example (Return value from *scanf()*)

```
1  #include <stdio.h>
2  int main()
3  {
4      int a,b;
5      int n;
6
7      printf("Enter two number: ");
8      n = scanf("%d%d",&a,&b);
9      printf("Total inputs are: %d\n", n);
10
11     return 0;
12 }
```

Output

Enter two number: 3 5
Total inputs are: 2



Expressions Solution (Contd...)

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Example (Formatted output)

```
1 #include <stdio.h>
2 int main()
3 {
4     int x=12345;
5     printf("\nNumber (d): %d", x);
6     printf("\nNumber (8d): %8d", x);
7     printf("\nNumber (-8d): %-8d", x);
8     printf("\nNumber (08d): %08d", x);
9
10    printf("\n");
11
12    float y = 12345.0123456789;
13    printf("\nNumber (f) : %f", y);
14    printf("\nNumber (5.3f) : %5.3f", y);
15    printf("\nNumber (0.4f) : %0.4f", y);
16    printf("\nNumber (0.16f) : %0.16f", y);
17    printf("\nNumber (2.2f) : %2.2f", y);
18    printf("\nNumber (-f) : %-f", y);
19    printf("\nNumber (15.4f) : %15.4f", y);
20    printf("\nNumber (-15.4f) : % -15.4f", y);
21    printf("\nNumber (8.12f) : %8.12f", y);
22    return 0;
23 }
```

Output

```
Number (d): 12345
Number (8d): 12345
Number (-8d): 12345
Number (08d): 00012345

Number (f) : 12345.012695
Number (5.3f) : 12345.013
Number (0.4f) : 12345.0127
Number (0.16f) : 12345.0126953125000000
Number (2.2f) : 12345.01
Number (-f) : 12345.012695
Number (15.4f) : 12345.0127
Number (-15.4f) : 12345.0127
Number (8.12f) : 12345.012695312500
```



Expressions Solution (Contd...)

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Example (Expression)

```
1 #include <stdio.h>
2 int main()
3 {
4     int x;
5     x = (!10) || (10 + 20 != 200);
6     printf("Value of x: %d", x);
7     return 0;
8 }
```

Output

Value of x: 1



Expressions Solution (Contd...)

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Example (Pre/post Increment/Decrement)

```
1 #include <stdio.h>
2 int main ()
3 {
4     int x=-1;
5     printf("Values of x: %d %d %d",--x, x++, ++x);
6     return 0;
7 }
```

Output

Values of x: 0 0 0



Expressions Solution (Contd...)

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Example (Expression with Ternary Operator)

```
1 #include <stdio.h>
2 int main()
3 {
4     int x;
5     x = 5 < 8 ? 1 != 2 < 5 == 0 ? 10 : 20 : 30;
6     printf("Value of x: %d", x);
7     return 0;
8 }
```

Output

Value of x: 10



Expressions Solution (Contd...)

Example 8

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Example (Expression with Ternary Operator)

```
1 #include <stdio.h>
2 int main()
3 {
4     int x;
5     x = 2 > 5 != 1 ? 5 < 8 && 8 > 2 ? 15 : 10 : 20 : 30 : 40;
6     printf("Value of x: %d", x);
7     return 0;
8 }
```

Output

Value of x: 20



Expressions Solution (Contd...)

Example 9

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Example

```
1 #include <stdio.h>
2 int main()
3 {
4     int i = 5, j = 10, k = 15;
5     printf("%ld ", sizeof(k /= i + j));
6     printf("%d", k);
7     return 0;
8 }
```

Output

4 15



Expressions Solution (Contd...)

Example 10

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Example

```
1 #include <stdio.h>
2 int main()
3 {
4     //Assume sizeof character is 1 byte and sizeof integer is
5     4 bytes
6     printf("%ld", sizeof(printf("MGCUB")));
7     return 0;
8 }
```

Output

4



Expressions Solution (Contd...)

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Example

```
1 #include <stdio.h>
2 int main()
3 {
4     int x, y = 8;
5     x = --y--;
6     printf("\nValue of x: %d", x);
7     printf("\nValue of y: %d", y);
8     return 0;
9 }
```

Output

Value of x: 8
Value of y: 7



Expressions Solution (Contd...)

Example 12

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Example

```
1 #include <stdio.h>
2 int main()
3 {
4     int x = 5;
5     printf("\nMultiplication: %d", x++ * x++);
6     printf("\nDivision: %d", x++ / x++);
7     printf("\nRemaindering: %d", x++ % x++);
8     printf("\nAddition: %d", x++ + x++);
9     return 0;
10 }
```

Output

Multiplication: 30
Division: 0
Remaindering: 9
Addition: 23



Expressions Solution (Contd...)

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Example

```
1 #include <stdio.h>
2 int main()
3 {
4     int x = 20, y = 8, z;
5
6     z = x != 5 || y == 4;
7     printf("\nValue of z: %d", z);
8
9     z = x != 5 || y & 4;
10    printf("\nValue of z: %d", z);
11
12    return (0);
13 }
```

Output

Value of z: 1
Value of z: 1



Expressions Solution (Contd...)

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Example

```
1 #include <stdio.h>
2 int main()
3 {
4     int a = 011, b = 11, c=0x11, d=0b11;
5
6     printf("\nValue of a: %d", a);
7     printf("\nValue of b: %d", b);
8     printf("\nValue of c: %d", c);
9     printf("\nValue of d: %d", d);
10
11     return 0;
12 }
```

Output

Value of a: 9
Value of b: 11
Value of c: 17
Value of d: 3



Expressions Solution (Contd...)

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Example

```
1 #include <stdio.h>
2 int main(void)
3 {
4     int a;
5     int b = 3;
6     int x[10] = { 1, 2, 3, 4, 5 };
7     a = 7 - 4 * x[--b] - (9 % b);
8     printf("Value of a: %d", a);
9     return 0;
10 }
```

Output

Value of a: -6



Expressions Solution (Contd...)

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Example

```
1 #include <stdio.h>
2 int main(void)
3 {
4     int a;
5     int i = 1;
6     int b = 10 * i + sizeof(--i) + 4 - 10 / i;
7     printf("Value of b: %d", b);
8     return 0;
9 }
```

Output

Value of b: 8



Expressions Solution (Contd...)

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Example

```
1 #include<stdio.h>
2 int main()
3 {
4     int x;
5     x = 'A' > 'a' ? 5 : 6;
6     printf("Value of x: %d", x);
7     return 0;
8 }
```

Output

Value of x: 6



Expressions Solution (Contd...)

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Example

```
1 #include <stdio.h>
2 int main()
3 {
4     unsigned char a=0xFA;
5     a = (a>>4) | (a<<4);
6     printf("Value of a: %02X\n",a);
7     return 0;
8 }
```

Output

Value of a: AF



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Example

```
1 #include <stdio.h>
2 int main()
3 {
4     printf("Value is : %d", (20++));
5     printf("Value is : %d", (++20));
6     return 0;
7 }
```

Output

++ and – operators are applicable with operands/variables only.



Expressions Solution (Contd...)

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Example

```
1 #include <stdio.h>
2 int main()
3 {
4     int x=20;
5     x += (x++)+(++x)+x;
6     printf("Value of x: %d",x);
7     return 0;
8 }
```

Output

Value of x: 86



Excercise

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Excercise

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Excercise

Find out output of following program and explain outputs.

```
1 #include <stdio.h>
2 int main()
3 {
4     int a = -1, b = -a;
5     int x, y;
6     x = (a > 0) && (b < 0) || (a < 0) && (b > 0);
7     y = (a <= 0) || (b >= 0) && (a >= 0) || (b <= 0);
8     printf("%d\n", x == y);
9     return 0;
10 }
```

```
1 #include <stdio.h>
2 int main()
3 {
4     int x;
5     x = 5 > 8 ? 10 : 1 != 2 < 5 ? 20 : 30;
6     printf("Value of x: %d", x);
7     return 0;
8 }
```



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Thank You...