CSC 215

Math and Computer Science



Data Types – VS 2017

- Integer
- Real
- Boolean



Boolean

• bool – 1 byte True or False



Integers – Characters

- char (1 byte)
 - signed -128 to 127
 - Unsigned 0 to 255

• Examples:

```
unsigned char ch;
signed char ch1;
char ch2;  // default is signed
```



ASCII Chart

0 to 127 in both signed and unsigned character types

0 0 000 NUL (null) 1 1 001 SOH (start of heading) 2 2 002 STX (start of text) 3 3 21 041 6#33; ! 65 41 101 6#65; A 97 61 141 6#97; a 34 22 042 6#34;" 66 42 102 6#66; B 98 62 142 6#96; b 3 3 003 ETX (end of text) 3 5 23 043 6#35; # 67 43 103 6#67; C 99 63 143 6#99; C 4 4 004 EOT (end of transmission) 5 5 005 ENQ (enquiry) 6 6 006 ACK (acknowledge) 7 7 007 BEL (bell) 8 8 010 BS (backspace) 9 9 011 TAB (horizontal tab) 10 A 012 LF (NL line feed, new line) 11 B 013 VT (vertical tab) 12 C 014 FF (NP form feed, new page) 13 D 015 CR (carriage return) 14 E 016 SO (shift out) 15 F 017 SI (shift in) 16 10 020 DLE (data link escape) 17 11 021 DC1 (device control 1) 18 12 022 DC2 (device control 2) 19 13 023 DC3 (device control 4) 21 15 025 NAK (negative acknowledge) 23 17 027 ETB (end of trans. block) 24 18 030 CAN (cancel) 25 19 031 EM (end of medium) 26 1A 032 SUB (substitute) 27 1B 033 ESC (escape) 43 20 040 6#33; ! 65 41 101 6#65; A 97 61 141 6#97; b 96 60 140 6#96; ` 33 21 044 6#33; ! 65 41 101 6#65; A 97 61 141 6#976; D 100 64 144 6#100; d 100 6#64; D 97 68 151 6#101; d 100 6#64; D 97 68 143 6#99; C 48 100 6#70; F 102 66 146 6#102; f 70 47 107 6#71; G 103 67 147 6#103; G 104 6#102; f 70 47 107 6#71; G 103 67 147 6#103; G 104 6#102; f 70 47 107 6#71; G 103 67 147 6#103; G 104 6#102; f 70 47 107 6#71; G 103 67 147 6#103; G 104 6#102; f 70 47 107 6#71; G 103 67 147 6#103; G 104 6#102; f 70 47 107 6#71; G 103 67 147 6#103; G 104 6#102; f 70 47 107 6#71; G 103 67 147 6#103; G 104 6#102; f 70 47 107 6#71; G 103 67 147 6#103; G 104 6#102; f 70 47 107 6#71; G 103 67 147 6#103; G 104 6#102; f 70 47 107 6#71; G 103 67 147 6#103; G 104 6#102; f 70 47 107 6#71; G 103 67 147 6#103; G 104 6#102; f 70 47 107 6#71; G 103 67 147 6#103; G 104 6#102; f 70 44 110 6#67; A 10	Dec Hx Oct Cha	ır	Dec	Нх	Oct	Html	Chr	Dec	Нх	Oct	Html	Chr	Dec	: Hx	Oct	Html Chr
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2 2 002 STX (start of text) 34 22 042 6#34;" 66 42 102 6#66; B 98 62 142 6#98; b 35 23 043 6#35; # 67 43 103 6#67; C 99 63 143 6#99; C 44 404 604 EOT (end of transmission) 62 40 044 6#36; 68 44 104 6#68; D 100 64 144 6#100; d 5 5 005 ENQ (enquiry) 37 25 045 6#37; % 69 45 105 6#69; E 101 65 145 6#101; e 7 046 106 6#70; F 102 66 146 6#102; f 7 046 106 6#70; F 102 66 146 6#102; f 7 1 47 107 6#71; G 103 67 147 6#103; g 8 8 010 BS (backspace) 40 28 050 6#40; (7 2 48 110 6#72; H 104 68 150 6#104; h 104 6# 150 6#104; h 104 6# 150 6#104; h 105 69 151 6#105; i 104 68 150 6#104; h 104 6#			33	21	041	a#33;	1	65	41	101	A	A	97	61	141	⊊#97; <mark>a</mark>
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17 11 021 DC1 (device control 1)	15 F 017 <mark>SI</mark>	(shift in)														
18 12 022 DC2 (device control 2)	16 10 020 DLE	(data link escape)	48	30	060	0	0									
19 13 023 DC3 (device control 3)	17 11 021 DC1	(device control 1)														
20 14 024 DC4 (device control 4)	18 12 022 DC2	(device control 2)														
21 15 025 NAK (negative acknowledge) 53 35 065 5 5 85 55 125 U U 117 75 165 u U 22 16 026 SYN (synchronous idle) 54 36 066 6 6 86 56 126 V V 118 76 166 v V 23 17 027 ETB (end of trans. block) 55 37 067 7 7 87 57 127 W W 119 77 167 w W 24 18 030 CAN (cancel) 56 38 070 8 8 88 58 130 X X 120 78 170 x X 25 19 031 EM (end of medium) 57 39 071 9 9 89 59 131 Y Y 121 79 171 y Y 26 1A 032 SUB (substitute) 58 3A 072 : : 90 5A 132 Z Z 122 7A 172 z Z	19 13 023 DC3	(device control 3)											1			
22 16 026 SYN (synchronous idle) 54 36 066 6 6 86 56 126 V V 118 76 166 v V 23 17 027 ETB (end of trans. block) 55 37 067 7 7 87 57 127 W W 119 77 167 w W 24 18 030 CAN (cancel) 56 38 070 8 8 88 58 130 X X 120 78 170 x X 25 19 031 EM (end of medium) 57 39 071 9 9 89 59 131 Y Y 121 79 171 y Y 26 1A 032 SUB (substitute) 58 3A 072 : : 90 5A 132 Z Z 122 7A 172 z Z	20 14 024 DC4	(device control 4)						ı								
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25 19 031 EM (end of medium) 57 39 071 6#57; 9 89 59 131 6#89; Y 121 79 171 6#121; Y 26 1A 032 SUB (substitute) 58 3A 072 6#58; 90 5A 132 6#90; Z 122 7A 172 6#122; Z								ı - ·								
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	25 19 031 EM	(end of medium)														
27 IB 033 FGC (eggene) 50 3B 073 x#59: 01 5B 133 x#91: [122 7B 172 x#123: [90								
1	27 1B 033 ESC	(escape)						91				-				
28 1C 034 FS (file separator) 60 3C 074 < < 92 5C 134 \ \ 124 7C 174 \	28 1C 034 FS	(file separator)											I — — —			
29 1D 035 GS (group separator) 61 3D 075 = = 93 5D 135]] 125 7D 175 } }		(group separator)										-	1			
30 1E 036 RS (record separator) 62 3E 076 > > 94 5E 136 ^ ^ 126 7E 176 ~ ~		(record separator)														
31 1F 037 US (unit separator) 63 3F 077 6#63; 2 95 5F 137 6#95; _ 127 7F 177 6#127; DEL	31 1F 037 <mark>US</mark>	(unit separator)	63	3 F	077	?	?	95	5F	137	a#95;	_	127	7 F	177	DEL

Source: www.LookupTables.com



Extended ASCII Chart

Values 128 to 255 in unsigned Values -128 to -1 in signed

```
144
                                                                           240
129
                                                                           241
          145
                     161
                                177
130
          146
                                                                           242
                     162
                                178
                                                     210
131
          147
                                                     211
                                                                           243
                                179
                                                                           244
                                                                 228
132
          148
                                180
                                                                      Σ
                      164
                                                                 229
          149
                                           197
                                                     213
                                                                           245
                     165
                                181
          150 û
                                                                230
                                                                           246
                     166
                                                     214
          151 ù
                     167
                                183
136
          152 ÿ
                                                                           248
                     168
                                184
                                                     216
                                                                 232
          153 Ö.
                                185
                                                     217
                                                                 233
                                                                           249
          154 Ü
138
                     170
                                186
                                                     218
                                                                 234
                                                                           250
139
          155 ....
                                                                235
                                                                           251
                     171
                          1/2
                                187
140
          156 €
                     172
                                                                 236
                                                                           252
141 i
          157 ¥
                     173
                                189
   Ä
142
          158
                     174
                                190
143
                                                                           255
                     175
                                191
                                                                www.LookupTables.com
```



Integers

```
short int
                 (signed and unsigned) (2 bytes)
                 (signed and unsigned) (4 bytes)
long int
long long int
                (signed and unsigned) (8 bytes)
short int num1;
long int num2;
int num3;
unsigned long long int num4;
```



Integer Ranges

- short int
 - signed -32768 to 32767
 - unsigned 0 to 65535
- long int
 - signed -2,147,483,648 to 2,147,483,647
 - unsigned0 to 4,294,967,295
- long long int
 - signed -9,223,372,036,854,775,808 to 9,223,372,036,854,775,807
 - Unsigned 0 to 18,446,744,073,709,551,615



Real Numbers

- float (4 bytes) 3.4E +/- 38 (6 digits of precision)
- double (8 bytes)
 1.7E +/- 308 (15 digits of precision)
- long double (8 bytes)
 - Same as double in Visual Studio 2017
 - (16 bytes once new standard is implemented)



Header files

Integer Types

```
C:\Program Files (x86)\Microsoft Visual
Studio\2017\Enterprise\VC\Tools\MSVC\14.11.25503\include
#include <climits> // includes limits.h
```

Real Types

```
C:\Program Files (x86)\Windows Kits\10\Include\10.0.15063.0\ucrt
#include <cfloat> // includes float.h
```

