香港中文大學
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CSCI2510 Computer Organization

Tutorial 02: MASM Basic Structs and Operations

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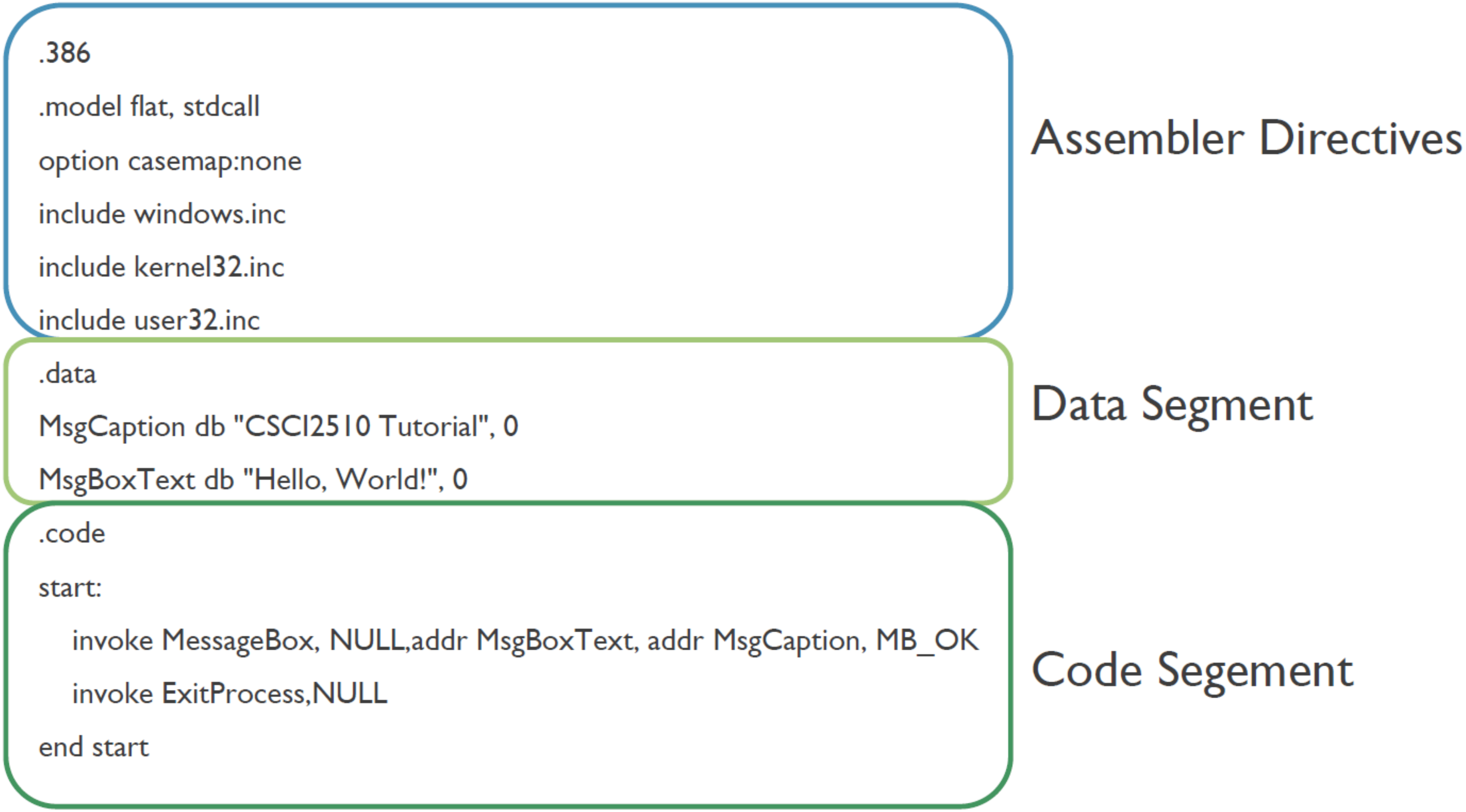
Review

- You can use the video demo for tuto 1 to revisit how to setup basic MASM environment and how to see register windows step by step:
  - http://www.cse.cuhk.edu.hk/~mcyang/csci2510.html

- Please create a new file for each program. If you want to have two assembly file in one project, please exclude all assembly file until only one included, and rebuild it.
  - [Right Click] the .asm file > [Exclude From Project].
  - You can include it again in [Project] > [Show All Files]

Program structure



```
.386
.model flat, stdcall
option casemap:none
include windows.inc
include kernel32.inc
include user32.inc
```

Assembler Directives

```
.data
MsgCaption db "CSCI2510 Tutorial", 0
MsgBoxText db "Hello, World!", 0
```

Data Segment

```
.code
start:
    invoke MessageBox, NULL,addr MsgBoxText, addr MsgCaption, MB_OK
    invoke ExitProcess,NULL
end start
```

Code Segement

Assembler Directives

- Telling the assembler what to do:
  - Option, configuration, syntax etc…
- .386
  - Use 80386 instruction set (intel 1985's architecture, most common supported)
- .model flat
  - Memory model of the assembly program
  - Only flat model is supported under Win32 program
- (.model) stdcall
  - Function calling convention, parameter passed from right to left (stack)

Includes Files

- casemap:none
  - The assembly is case insensitive
  - i.e. Label = label = lAbEl

- include windows.inc
- include kerner32.inc
  - Include the files, which handles the system calls
  - E.g. invoke ExitProcess, 0 (valid after include files)

- include user32.inc
  - Graphical User Interface (GUI) elements in windows

Data Segment & Datatypes

- “.data” is also assembly directives
  - Declare and apply some memory space in primary memory (e.g. RAM)

- Datatypes: integer ➔ DB, DW, DWORD, DQ
  - SINGLEBYTE DB, 8-bits
  - TWOBYTE DW, 16-bits
  - FOURBYTE DWORD, 32-bits
  - EIGHTBYTE DQ, 64-bits

Data Segment & Datatypes

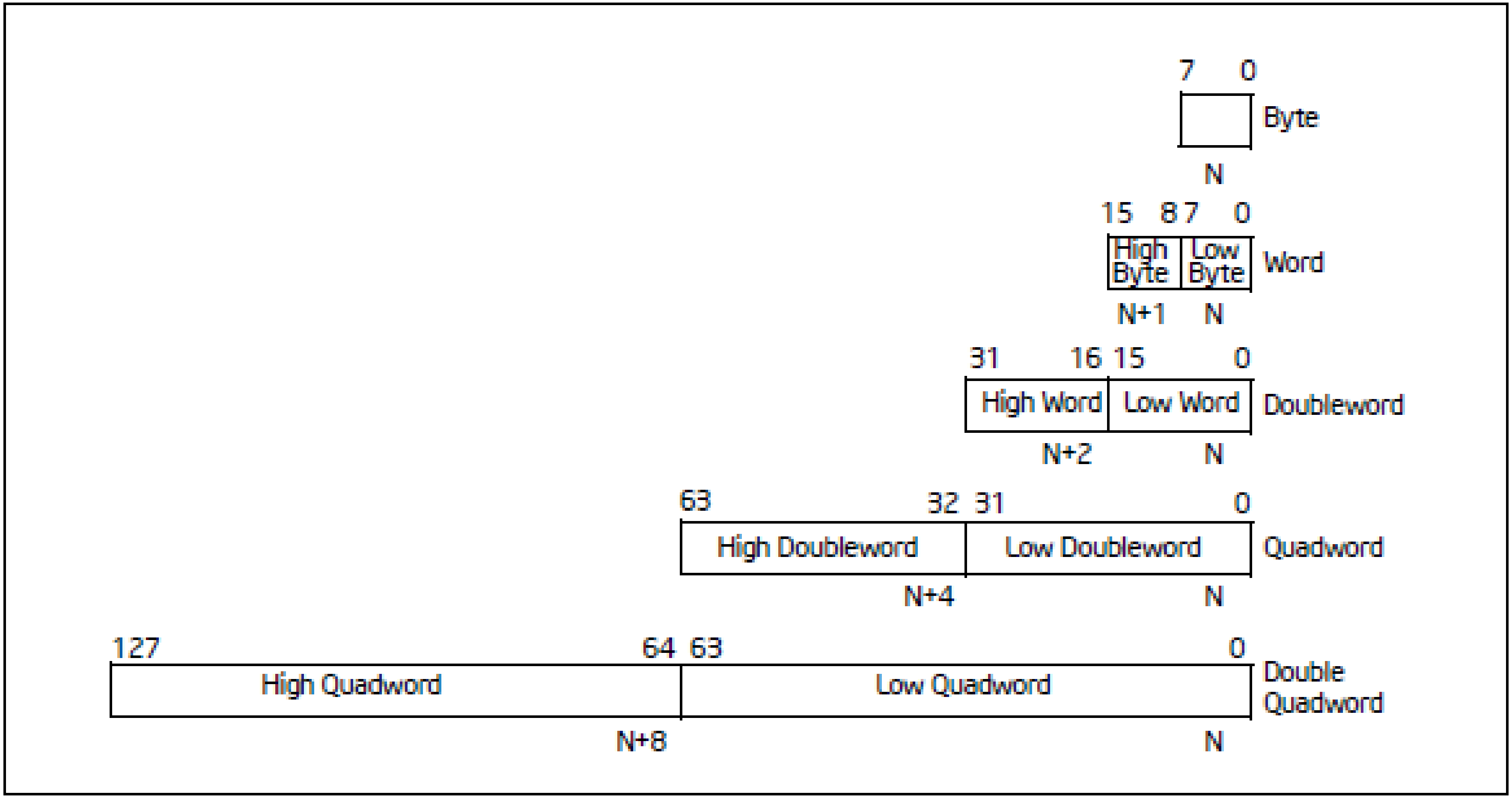


Figure 4-1. Fundamental Data Types

Code Segment

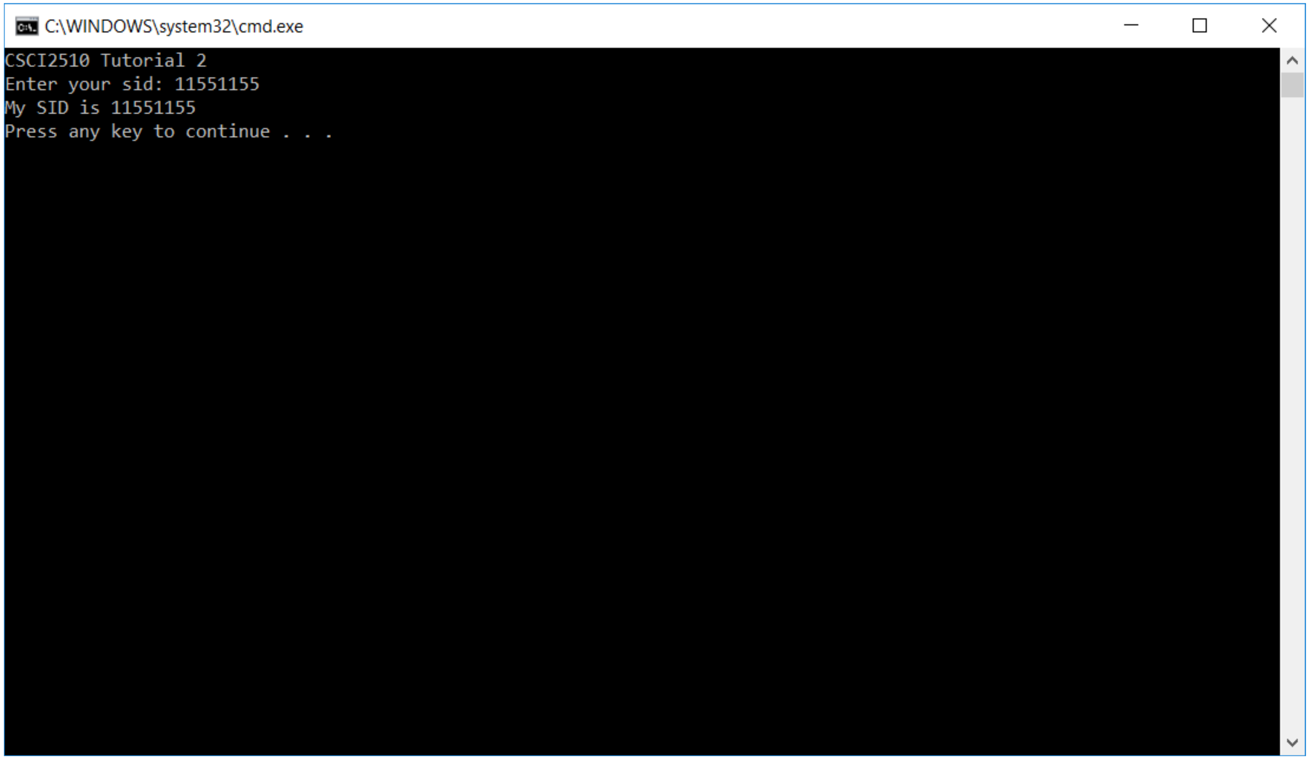
- “.code” is also assembly directives
  - State the following segment is the program assembly code

- start:
  - Label that indicates where should the program begins
  - End function with “end start”

- Comment in masm: “;”
  - It will directly comment the whole line

I/O (Console)

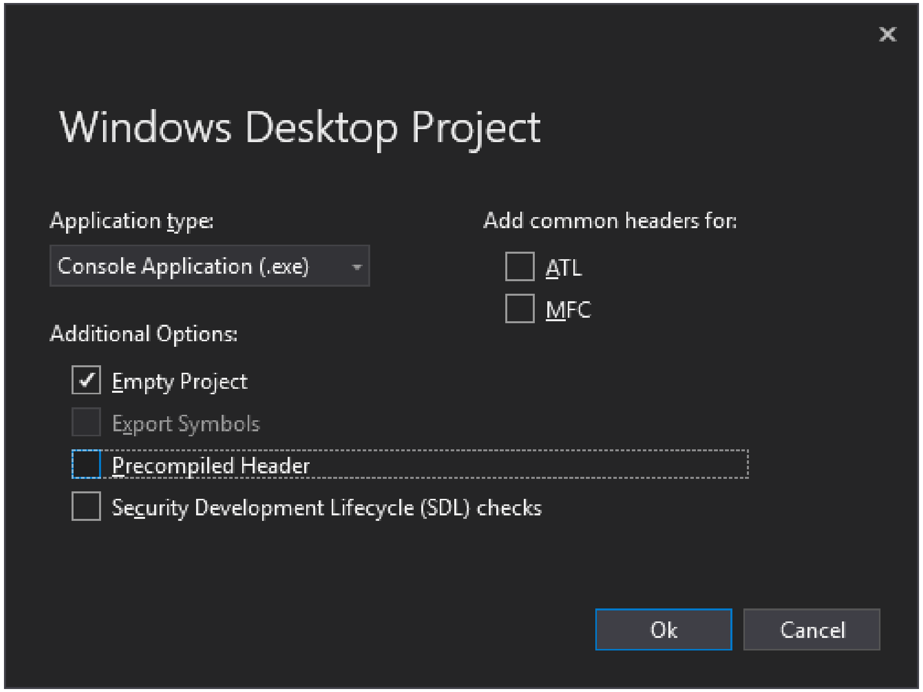
- C style function to input/output information
  - crt_printf: print like a C program (like printf() in C)
  - crt_scanf: read the input (like scanf() in C)
  - console application
- Example:



```
CSCI2510 Tutorial 2
Enter your sid: 11551155
My SID is 11551155
Press any key to continue . . .
```

I/O (Console)

- Download the new library:
  - In Blackboard -> CSCI2510 -> course content -> msvcrt.zip
- Open VS community, click [New] > [Project] > [Visual C++] > [Windows Desktop] > [Windows Desktop Wizard] > [Console application] > only choose [Empty project].



Windows Desktop Project

Application type: Console Application (.exe)

Add common headers for:

□ ATL

□ MFC

Additional Options:

☑ Empty Project

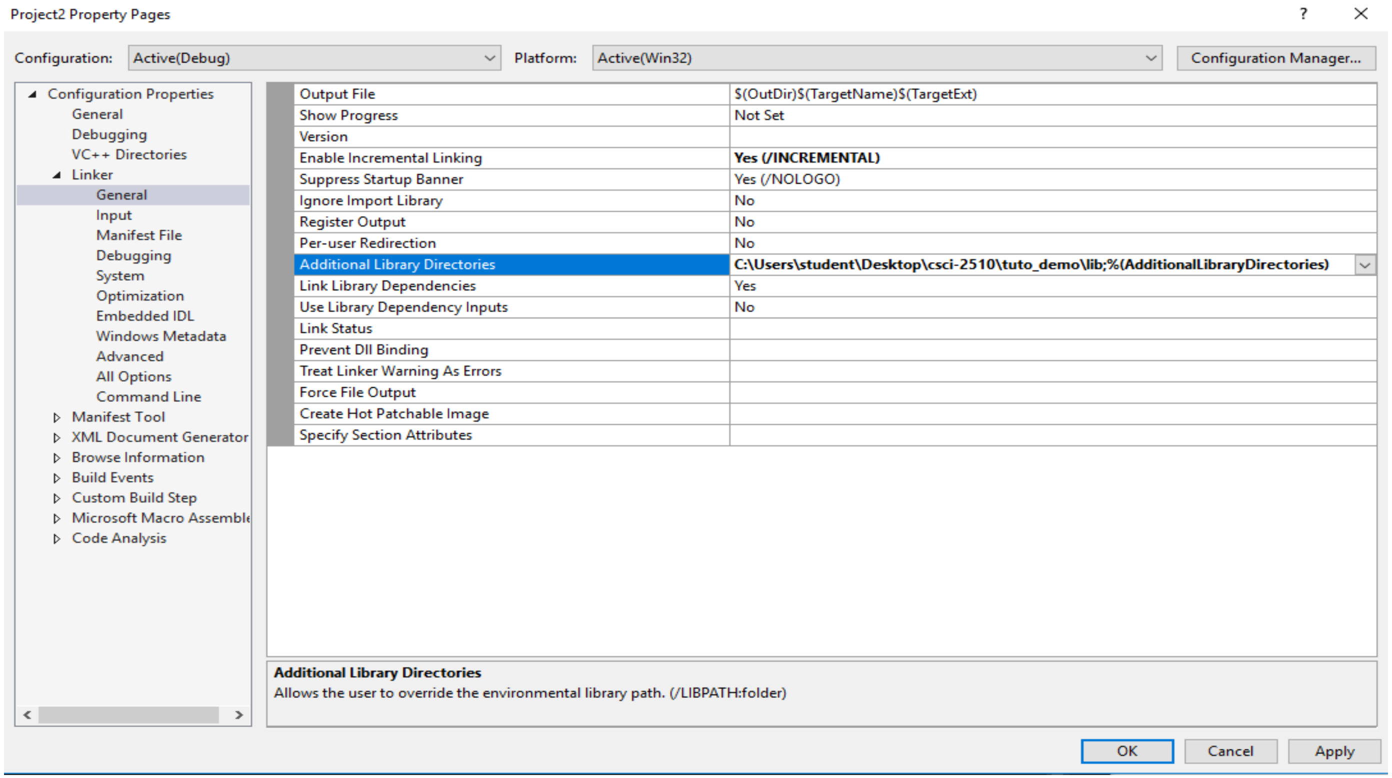
□ Export Symbols

□ Precompiled Header

□ Security Development Lifecycle (SDL) checks

I/O (Console)

- Configure the project setting **like the previous program**
  - Left the Subsystem be [Console] instead of [Windows]
- In the [Project] > [Property], add the newly downloaded library to [Linker] > [General] > [Additional Library Directories]
  - e.g. D:\csci2510\lib



Configuration: Active(Debug)   Platform: Active(Win32)

Output File	$(OutDir)$(TargetName)$(TargetExt)
Show Progress	Not Set
Version	
Enable Incremental Linking	**Yes (/INCREMENTAL)**
Suppress Startup Banner	Yes (/NOLOGO)
Ignore Import Library	No
Register Output	No
Per-user Redirection	No
Additional Library Directories	**C:\Users\student\Desktop\csci-2510\tuto_demo\lib;%(AdditionalLibraryDirectories)**
Link Library Dependencies	Yes
Use Library Dependency Inputs	No
Link Status	
Prevent Dll Binding	
Treat Linker Warning As Errors	
Force File Output	
Create Hot Patchable Image	
Specify Section Attributes	

Additional Library Directories
Allows the user to override the environmental library path. (/LIBPATH:folder)

Reference for Programming ex1

```
.386
.model flat, stdcall
option casemap:none
include windows.inc
include kernel32.inc
include msvcrt.inc
includelib msvcrt.lib
.data
APrompt db "CSCI2510 Tutorial 2", 10, 0
.code
start:
        invoke crt_printf, addr APrompt
        invoke ExitProcess, NULL
end start
; press Ctrl + F5 to prevent instant quit after program execution
```

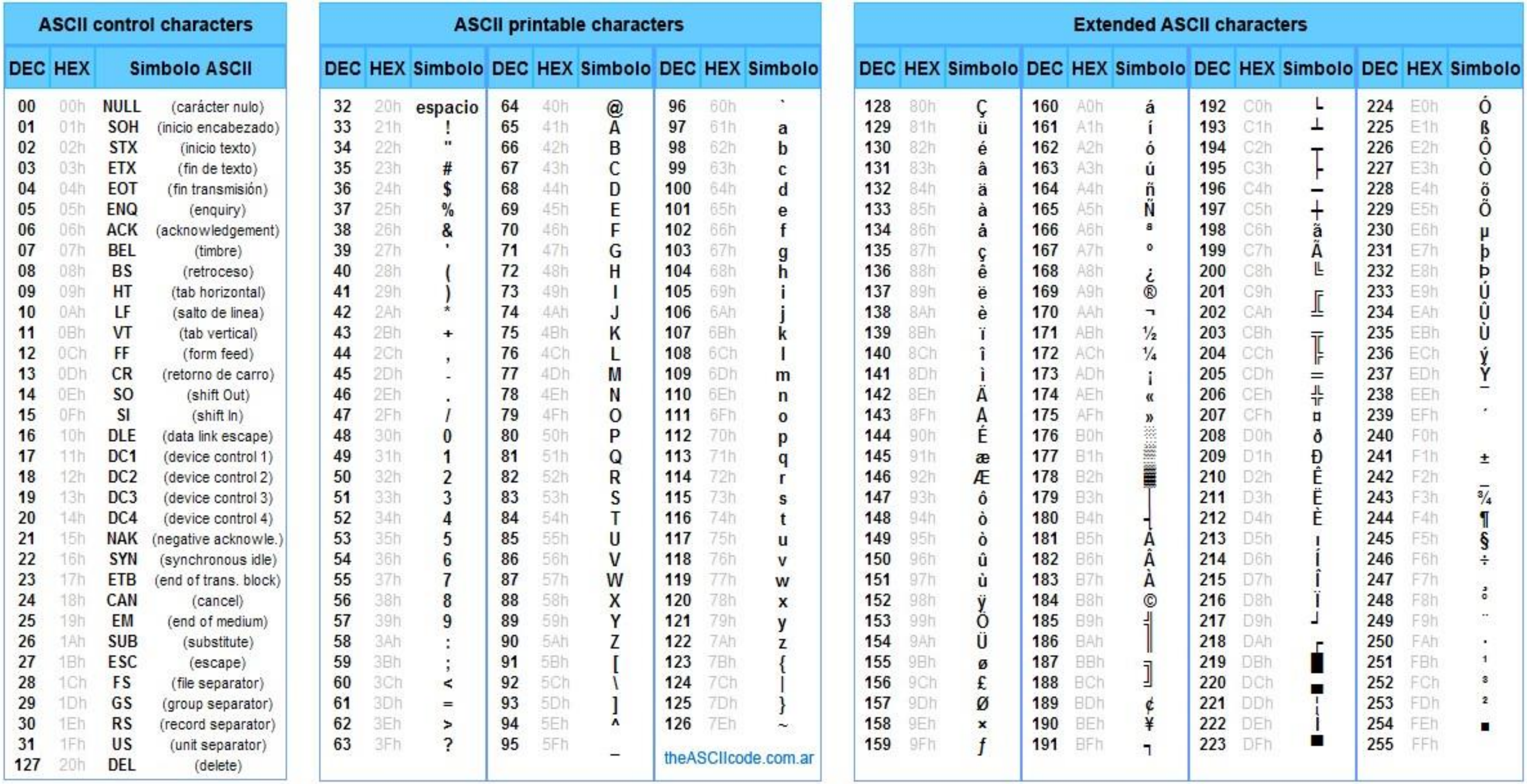
Hints for HW1

- For question 1, you can find corresponding concepts in lecture 01, please answer the questions in your own words.

- For question 2, you can find corresponding concepts in lecture 02.

- For question 3, you can find corresponding concepts in lecture 03.

Extended ASCII for HW1 Q2



ASCII control characters			
DEC	HEX	Simbolo ASCII	
00	00h	NULL	(carácter nulo)
01	01h	SOH	(inicio encabezado)
02	02h	STX	(inicio texto)
03	03h	ETX	(fin de texto)
04	04h	EOT	(fin transmisión)
05	05h	ENQ	(enquiry)
06	06h	ACK	(acknowledgement)
07	07h	BEL	(timbre)
08	08h	BS	(retroceso)
09	09h	HT	(tab horizontal)
10	0Ah	LF	(salto de linea)
11	0Bh	VT	(tab vertical)
12	0Ch	FF	(form feed)
13	0Dh	CR	(retorno de carro)
14	0Eh	SO	(shift Out)
15	0Fh	SI	(shift In)
16	10h	DLE	(data link escape)
17	11h	DC1	(device control 1)
18	12h	DC2	(device control 2)
19	13h	DC3	(device control 3)
20	14h	DC4	(device control 4)
21	15h	NAK	(negative acknowle.)
22	16h	SYN	(synchronous idle)
23	17h	ETB	(end of trans. block)
24	18h	CAN	(cancel)
25	19h	EM	(end of medium)
26	1Ah	SUB	(substitute)
27	1Bh	ESC	(escape)
28	1Ch	FS	(file separator)
29	1Dh	GS	(group separator)
30	1Eh	RS	(record separator)
31	1Fh	US	(unit separator)
127	20h	DEL	(delete)

ASCII printable characters								
DEC	HEX	Simbolo	DEC	HEX	Simbolo	DEC	HEX	Simbolo
32	20h	espacio	64	40h	@	96	60h	`
33	21h	!	65	41h	A	97	61h	a
34	22h	"	66	42h	B	98	62h	b
35	23h	#	67	43h	C	99	63h	c
36	24h	$	68	44h	D	100	64h	d
37	25h	%	69	45h	E	101	65h	e
38	26h	&	70	46h	F	102	66h	f
39	27h	'	71	47h	G	103	67h	g
40	28h	(	72	48h	H	104	68h	h
41	29h	)	73	49h	I	105	69h	i
42	2Ah	*	74	4Ah	J	106	6Ah	j
43	2Bh	+	75	4Bh	K	107	6Bh	k
44	2Ch	,	76	4Ch	L	108	6Ch	l
45	2Dh	-	77	4Dh	M	109	6Dh	m
46	2Eh	.	78	4Eh	N	110	6Eh	n
47	2Fh	/	79	4Fh	O	111	6Fh	o
48	30h	0	80	50h	P	112	70h	p
49	31h	1	81	51h	Q	113	71h	q
50	32h	2	82	52h	R	114	72h	r
51	33h	3	83	53h	S	115	73h	s
52	34h	4	84	54h	T	116	74h	t
53	35h	5	85	55h	U	117	75h	u
54	36h	6	86	56h	V	118	76h	v
55	37h	7	87	57h	W	119	77h	w
56	38h	8	88	58h	X	120	78h	x
57	39h	9	89	59h	Y	121	79h	y
58	3Ah	:	90	5Ah	Z	122	7Ah	z
59	3Bh	;	91	5Bh	[	123	7Bh	{
60	3Ch	<	92	5Ch	\	124	7Ch	|
61	3Dh	=	93	5Dh	]	125	7Dh	}
62	3Eh	>	94	5Eh	^	126	7Eh	~
63	3Fh	?	95	5Fh	_			

theASCIIcode.com.ar

Extended ASCII characters											
DEC	HEX	Simbolo	DEC	HEX	Simbolo	DEC	HEX	Simbolo	DEC	HEX	Simbolo
128	80h	Ç	160	A0h	á	192	C0h	└	224	E0h	Ó
129	81h	ü	161	A1h	í	193	C1h	┴	225	E1h	ß
130	82h	é	162	A2h	ó	194	C2h	┬	226	E2h	Ô
131	83h	â	163	A3h	ú	195	C3h	├	227	E3h	Ò
132	84h	ä	164	A4h	ñ	196	C4h	─	228	E4h	õ
133	85h	à	165	A5h	Ñ	197	C5h	┼	229	E5h	Õ
134	86h	å	166	A6h	ª	198	C6h	ã	230	E6h	µ
135	87h	ç	167	A7h	º	199	C7h	Ã	231	E7h	þ
136	88h	ê	168	A8h	¿	200	C8h	╚	232	E8h	Þ
137	89h	ë	169	A9h	®	201	C9h	╔	233	E9h	Ú
138	8Ah	è	170	AAh	¬	202	CAh	╩	234	EAh	Û
139	8Bh	ï	171	ABh	½	203	CBh	╦	235	EBh	Ù
140	8Ch	î	172	ACh	¼	204	CCh	╠	236	ECh	ý
141	8Dh	ì	173	ADh	¡	205	CDh	═	237	EDh	Ý
142	8Eh	Ä	174	AEh	«	206	CEh	╬	238	EEh	¯
143	8Fh	Å	175	AFh	»	207	CFh	¤	239	EFh	´
144	90h	É	176	B0h	░	208	D0h	ð	240	F0h	
145	91h	æ	177	B1h	▒	209	D1h	Ð	241	F1h	±
146	92h	Æ	178	B2h	▓	210	D2h	Ê	242	F2h	‗
147	93h	ô	179	B3h	│	211	D3h	Ë	243	F3h	¾
148	94h	ö	180	B4h	┤	212	D4h	È	244	F4h	¶
149	95h	ò	181	B5h	Á	213	D5h	ı	245	F5h	§
150	96h	û	182	B6h	Â	214	D6h	Í	246	F6h	÷
151	97h	ù	183	B7h	À	215	D7h	Î	247	F7h	¸
152	98h	ÿ	184	B8h	©	216	D8h	Ï	248	F8h	°
153	99h	Ö	185	B9h	╣	217	D9h	┘	249	F9h	¨
154	9Ah	Ü	186	BAh	║	218	DAh	┌	250	FAh	·
155	9Bh	ø	187	BBh	╗	219	DBh	█	251	FBh	¹
156	9Ch	£	188	BCh	╝	220	DCh	▄	252	FCh	³
157	9Dh	Ø	189	BDh	¢	221	DDh	¦	253	FDh	²
158	9Eh	×	190	BEh	¥	222	DEh	Ì	254	FEh	■
159	9Fh	ƒ	191	BFh	┐	223	DFh	▀	255	FFh	

Hint for Q2

- Example to translate a 16-bits word into string of characters:
  - E641h, find the corresponding hex in extended ASCII table
    - E6h ➔ 230 E6h µ
    - 41h ➔ 65 41h A
    - So the result is “µA”.
- You can find how to interpret a word in other methods in slide of lecture 02.

Summary

- Reference for programming exercise 1

- Hints for HW1 Q1-Q3