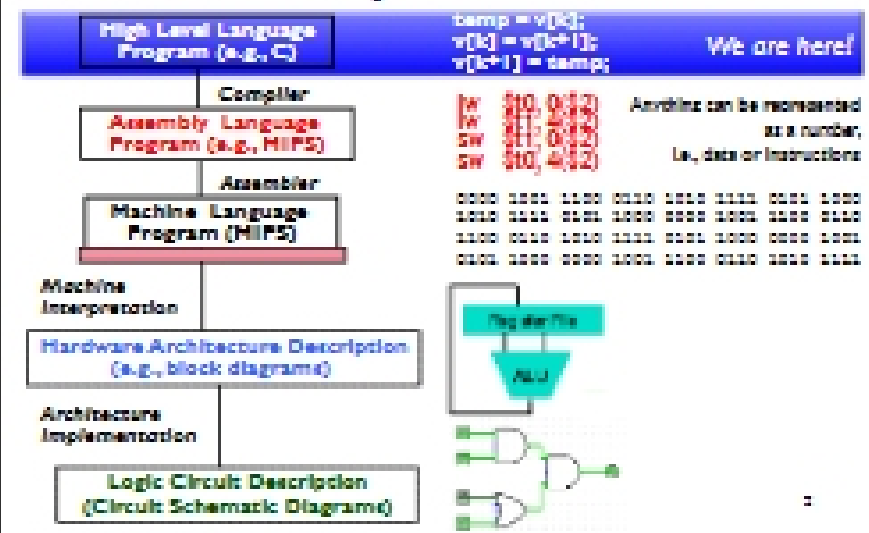


Lecture 3: Introduction to C

(CPEG323: Intro. to Computer System Engineering)

Levels of Representation/ Interpretation



Introduction to C

- You will not learn how to fully code in C in these lectures!
- Key C concepts
 - Pointers
 - Arrays
 - Implications for memory management

Compilation: Overview

- C compilers map C programs into architecture-specific machine code (string of 1s and 0s)
 - compiling .c files to .o files, then linking the .o files into executables; *Assembling* is also done (but is hidden, i.e., done automatically, by default)
- Advantages:
 - Excellent run-time performance
 - Allow us to exploit underlying features of the architecture
- Disadvantages:
 - Compiled files are *architecture-specific*, depending on CPU type and the operating system
 - Executable must be *rebuilt* on each new system
 - i.e., "porting your code" to a new architecture
 - "change → compile → run" iteration cycle can be slow, during the development cycle.

Typed Variables in C

```
int x = 2;
float y = 1.618;
char z = 'A';
```

You have to declare the type of data a variable will hold

Type	Description	Examples
int	signed integer	5, -12, 0
short int (short)	smaller signed integer	
long int (long)	larger signed integer	
char	single text character or symbol	'a', 'D', '?'
float	floating point non-integer numbers	0.0, 1.618, -1.4
double	greater precision FP number	

- Integer sizes are machine dependant!
 - *Common size is 4 bytes, but can't ever assume this.
- Can add "unsigned" before int or char type for unsigned
 - *eg unsigned int

Characters

- How do we encode characters?
- Relevant question: How many different characters do we want to encode?
 - 'a'-'z', 'A-Z', '0-9'
 - What else?

Characters

- ASCII standard - 128 different characters and their numeric encodings.
 - A char representing the character 'a' contains 97.
 - char c = 'a'; or char c = 97 are both valid
- 7 bits is enough to store a char ($2^7 = 128$), round up to 1 byte since computers usually only deal with multiples of bytes.

Code	Character	Code	Character	Code	Character	Code	Character	Code	Character
0		16	P	32	T	48	X	64	z
1	!	17	Q	33	U	49	Y	65	{
2	"	18	R	34	V	50	Z	66	|
3	#	19	S	35	W	51	[	67	~
4	\$	20	T	36	X	52	\	68	
5	%	21	U	37	Y	53	^	69	
6	&	22	V	38	Z	54	_	70	
7	'	23	W	39	[	55	`	71	
8	(	24	X	40	\	56	~	72	
9	)	25	Y	41	^	57		73	
10	*	26	Z	42	_	58		74	
11	+	27	[	43		59		75	
12	,	28	\	44		60		76	
13	-	29	^	45		61		77	
14	.	30	_	46		62		78	
15	/	31		47		63		79	
16	0	32		48		64		80	
17	1	33		49		65		81	
18	2	34		50		66		82	
19	3	35		51		67		83	
20	4	36		52		68		84	
21	5	37		53		69		85	
22	6	38		54		70		86	
23	7	39		55		71		87	
24	8	40		56		72		88	
25	9	41		57		73		89	
26	:	42		58		74		90	
27	;	43		59		75		91	
28	<	44		60		76		92	
29	=	45		61		77		93	
30	>	46		62		78		94	
31	?@	47		63		79		95	
32	A	48		64		80		96	¡
33	B	49		65		81		97	¢
34	C	50		66		82		98	£
35	D	51		67		83	¡	99	¤
36	E	52		68		84	¢	100	¥
37	F	53		69		85	£	101	¦
38	G	54		70		86	¤	102	§
39	H	55		71		87	¥	103	¨
40	I	56		72		88	¦	104	©
41	J	57		73		89	§	105	ª
42	K	58		74		90	¨	106	«
43	L	59		75		91	©	107	¬
44	M	60		76		92	ª	108	­
45	N	61		77		93	«	109	®
46	O	62		78		94	¬	110	¯
47	P	63		79		95	­	111	°
48	Q	64		80		96	®	112	±
49	R	65		81		97	¯	113	²
50	S	66		82		98	°	114	³
51	T	67		83		99	±	115	´
52	U	68		84		100	²	116	µ
53	V	69		85		101	³	117	¶
54	W	70		86		102	´	118	·
55	X	71		87		103	µ	119	¸
56	Y	72		88		104	¶	120	¹
57	Z	73		89		105	·	121	º
58	[	74		90		106	¸	122	»
59	\	75		91		107	¹	123	¼
60	^	76		92		108	º	124	½
61	_	77		93		109	»	125	¾
62		78		94		110	¼	126	¿
63		79		95		111	½	127	
64		80		96		112	¾	128	
65		81		97		113	¿	129	
66		82		98		114		130	
67		83		99		115		131	
68		84		100		116		132	
69		85		101		117		133	
70		86		102		118		134	
71		87		103		119		135	
72		88		104		120		136	
73		89		105		121		137	
74		90		106		122		138	
75		91		107		123		139	
76		92		108		124		140	
77		93		109		125		141	
78		94		110		126		142	
79		95		111		127		143	
80		96		112		128		144	
81		97		113		129		145	
82		98		114		130		146	
83		99		115		131		147	
84		100		116		132		148	
85		101		117		133		149	
86		102		118		134		150	
87		103		119		135		151	
88		104		120		136		152	
89		105		121		137		153	
90		106		122		138		154	
91		107		123		139		155	
92		108		124		140		156	
93		109		125		141		157	
94		110		126		142		158	
95		111		127		143		159	
96		112		128		144		160	
97		113		129		145		161	
98		114		130		146		162	
99		115		131		147		163	
100		116		132		148		164	
101		117		133		149		165	
102		118		134		150		166	
103		119		135		151		167	
104		120		136		152		168	
105		121		137		153		169	
106		122		138		154		170	
107		123		139		155		171	
108		124		140		156		172	
109		125		141		157		173	
110		126		142		158		174	
111		127		143		159		175	
112		128		144		160		176	
113		129		145		161		177	
114		130		146		162		178	
115		131		147		163		179	
116		132		148		164		180	
117		133		149		165		181	
118		134		150		166		182	
119		135		151		167		183	
120		136		152		168		184	
121		137		153		169		185	
122		138		154		170		186	
123		139		155		171		187	
124		140		156		172		188	
125		141		157		173		189	
126		142		158		174		190	
127		143		159		175		191	
128		144		160		176		192	
129		145		161		177		193	
130		146		162		178		194	
131		147		163		179		195	
132		148		164		180		196	
133		149		165		181		197	
134		150		166		182		198	
135		151		167		183		199	
136		152		168		184		200	
137		153		169		185		201	
138		154		170		186		202	
139		155		171		187		203	
140		156		172		188		204	
141		157		173		189		205	
142		158		174		190		206	
143		159		175		191		207	
144		160		176		192		208	
145		161		177		193		209	
146		162		178		194		210	
147		163		179		195		211	
148		164		180		196		212	
149		165		181		197		213	
150		166		182		198		214	
151		167		183		199		215	
152		168		184		200		216	
153		169		185		201		217	
154		170		186		202		218	
155		171		187		203		219	
156		172		188		204		220	
157		173							

