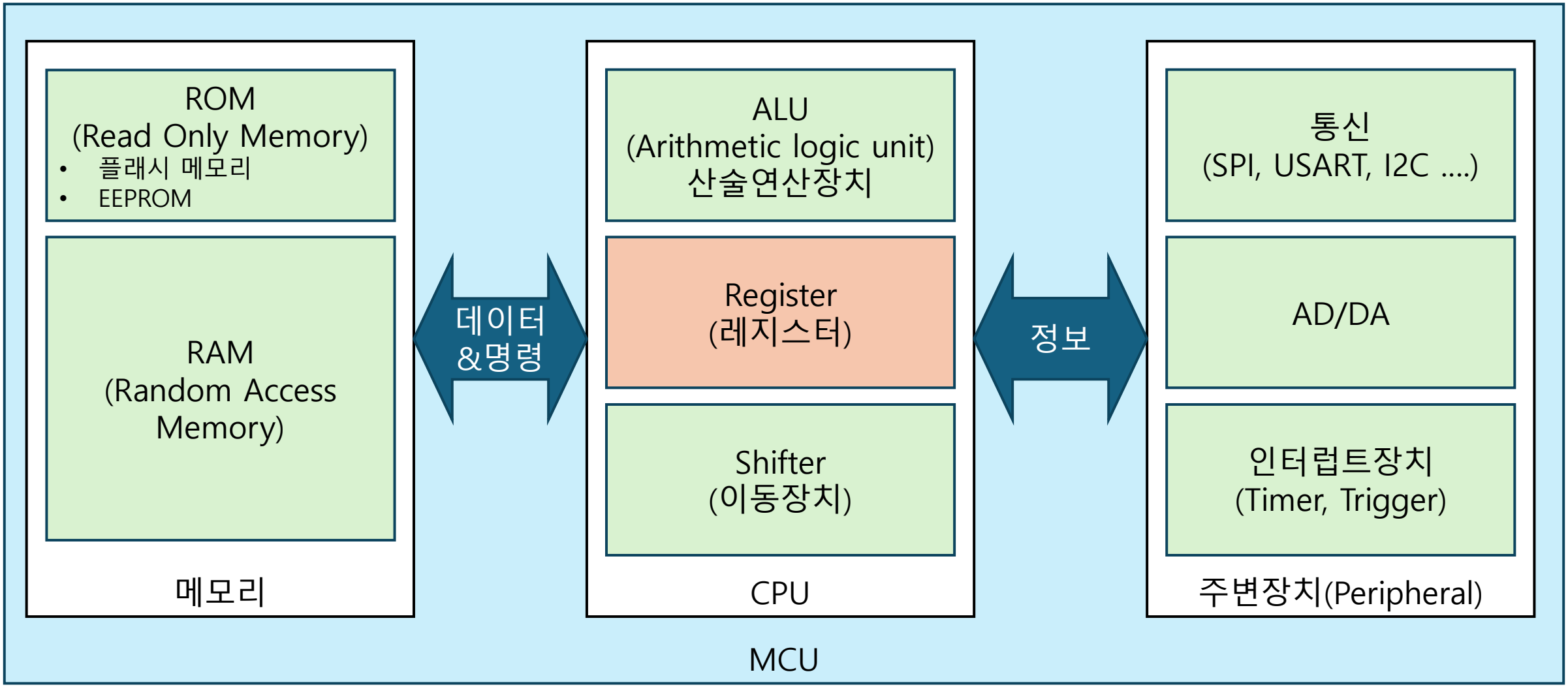
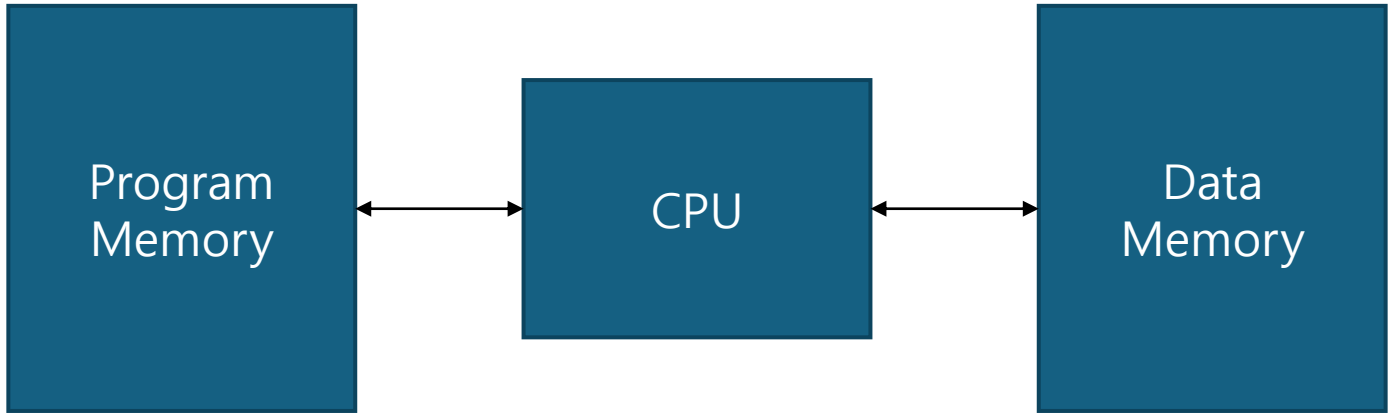
레지스터와 포트의 이해 그리고 C언어

마이크로프로세서 종합 설계. 3주차.

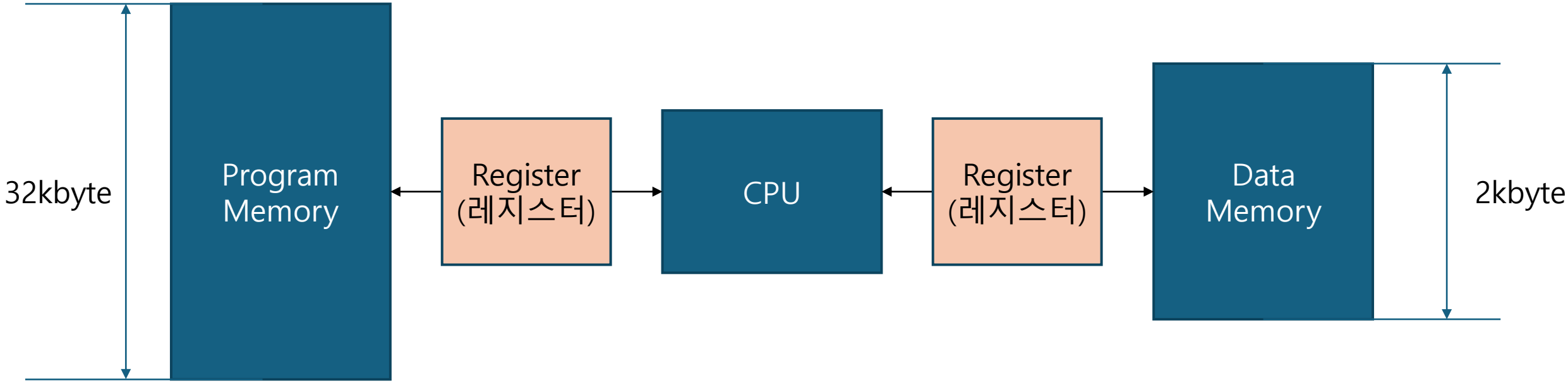
마이크로프로세서의 기본 구성



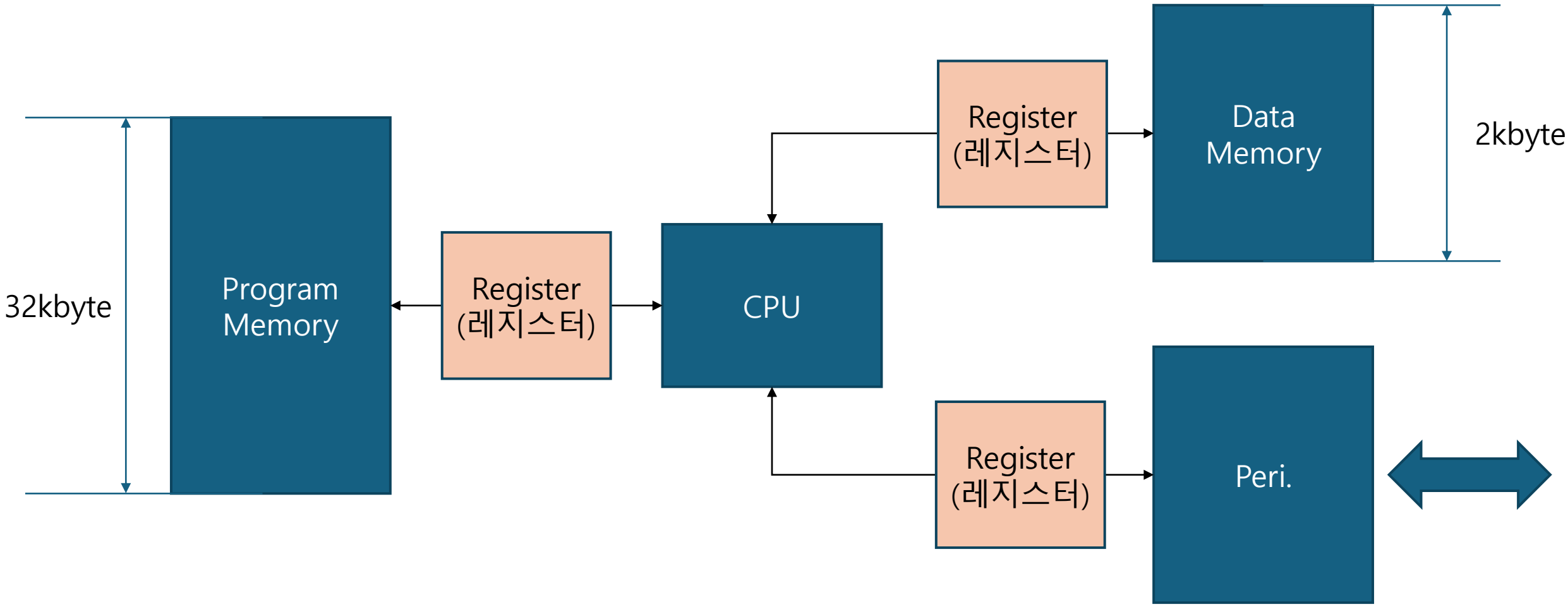
하버드 구조(Harvard architecture)



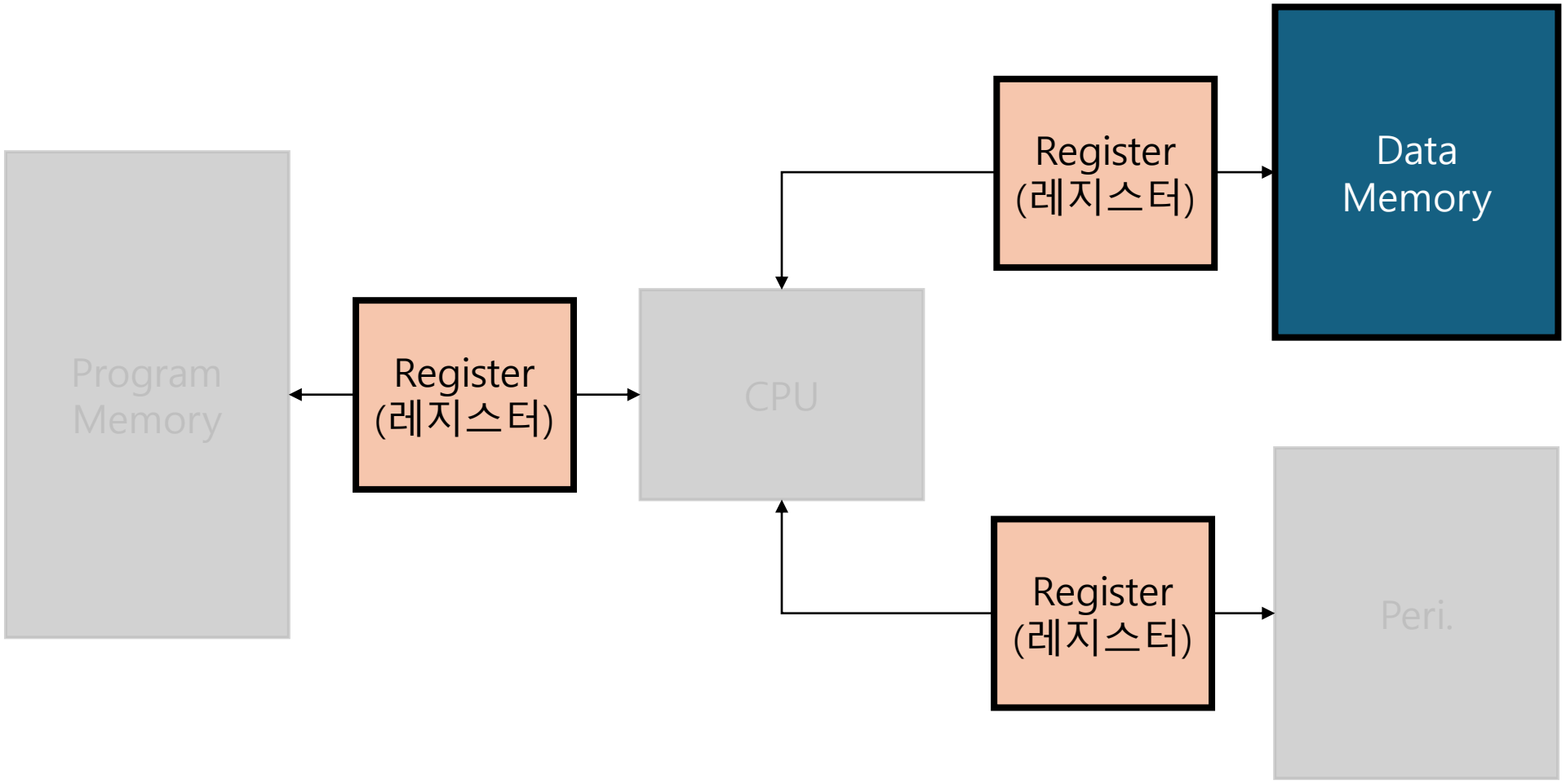
Atmega328p의 메모리



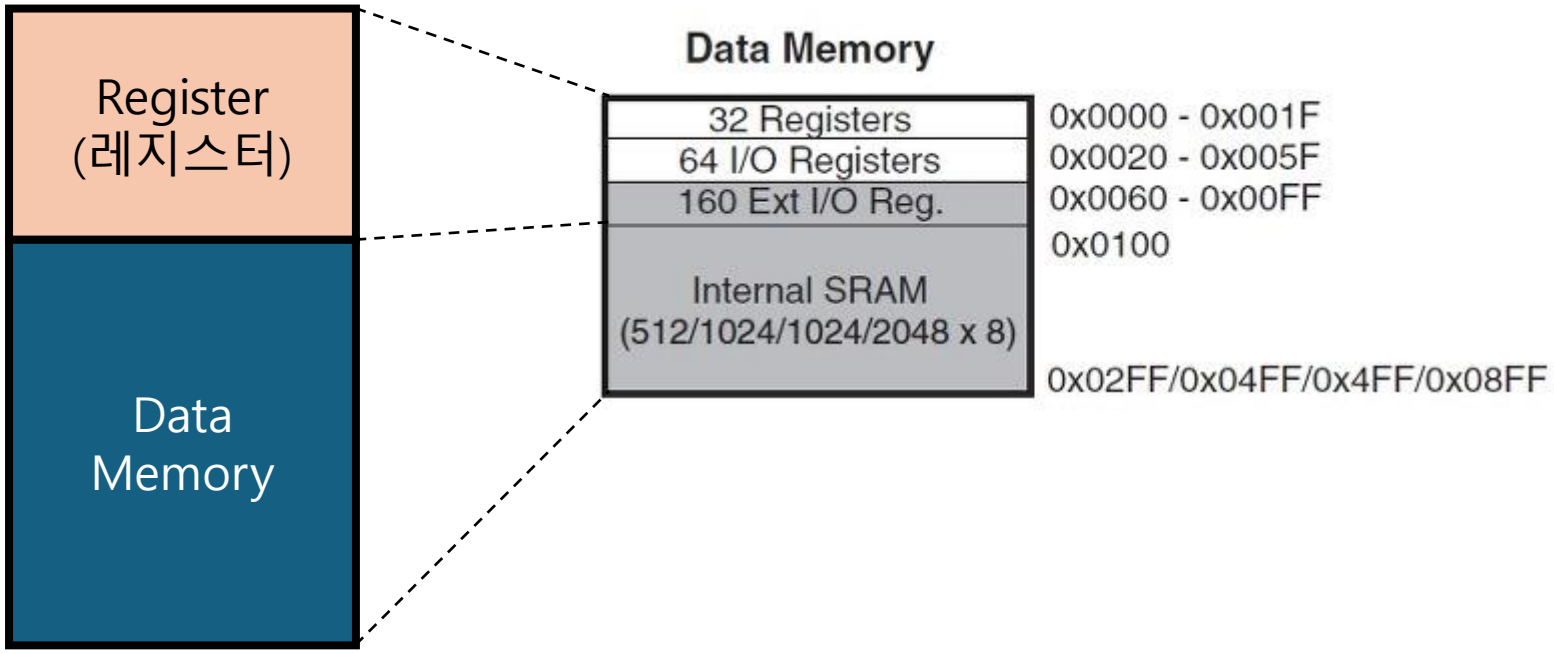
Atmega328p의 메모리 & 외부장치



Atmega328p의 메모리맵

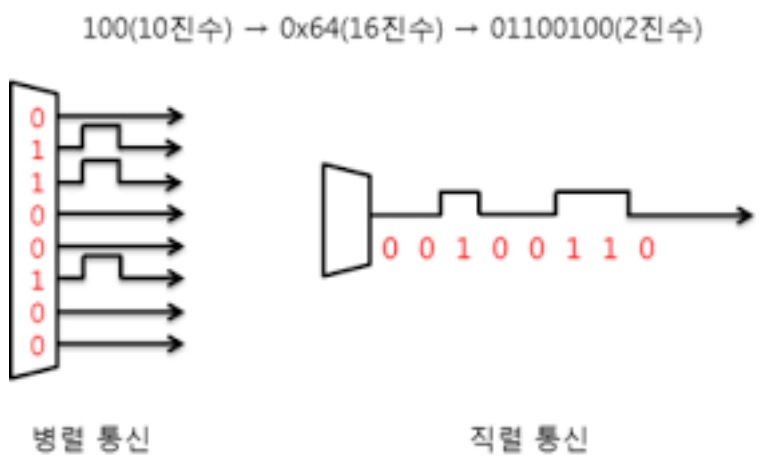


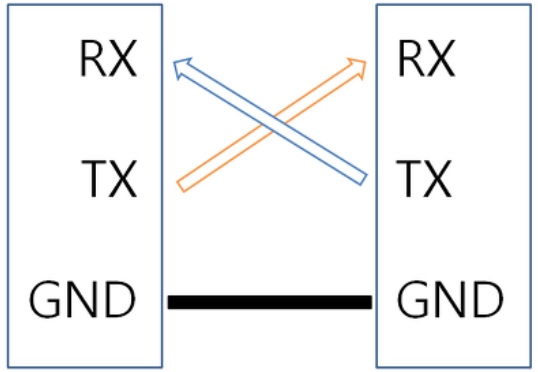
Atmega328p의 메모리맵



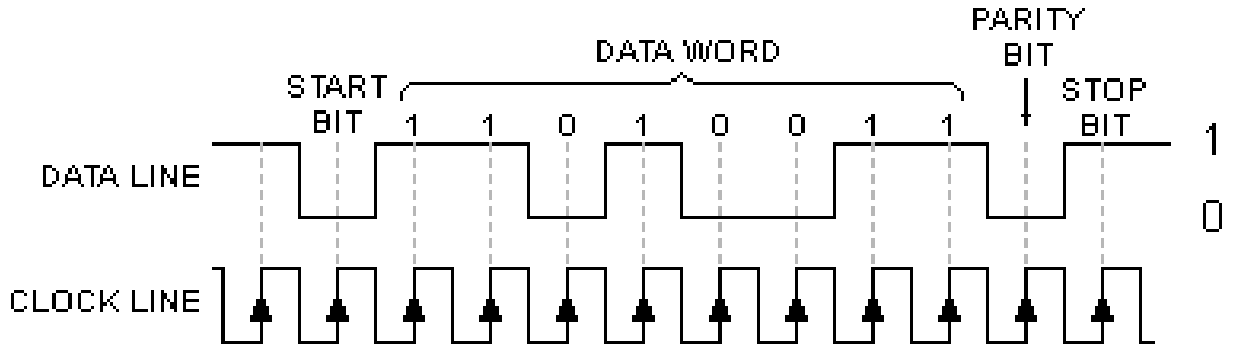
데이타시트 : https://ww1.microchip.com/downloads/en/DeviceDoc/Atmel-7810-Automotive-Microcontrollers-ATmega328P_Datasheet.pdf
30. Register Summary, 275 page 참고

마이크로프로세서와 C언어 - 시리얼통신





직렬통신의 연결



동기/비동기 통신

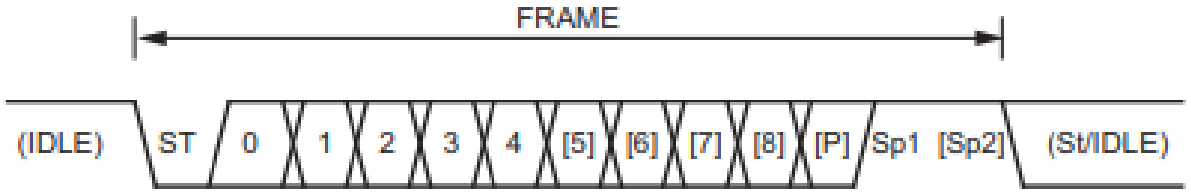
마이크로프로세서와 C언어 - 시리얼통신

- **비동기식 시리얼 통신**
  - UART 통신을 이용하기 위해서는 크게 다음의 두 가지 항목을 사전에 정의해줘야 한다.
    - **통신속도 : Baud rate**
      - Baud rate 의 단위는 bps(bits per second) : 1초당 전송하는 bit 수
      - 표준 bps: 1200, 2400, 4800, **9600**, 19200, 38400, 57600, 115200
    - **프레임사이즈 : Size of each frame field**
      - 일반적으로
        - Data bit는 1
        - Bytes site = 8 bits 사이즈로 설정
        - Stop bit는 1 bit
        - Parity bit는 0 bit로 설정
      - 통신을 사용하는 환경에 따라 미리 약속하여 사용

마이크로프로세서와 C언어 - 시리얼통신

- 시리얼통신 데이터 포멧

Figure 19-4. Frame Formats



St	Start bit, always low.
(n)	Data bits (0 to 8).
P	Parity bit. Can be odd or even.
Sp	Stop bit, always high.
IDLE	No transfers on the communication line (RxDn or TxDn). An IDLE line must be high.

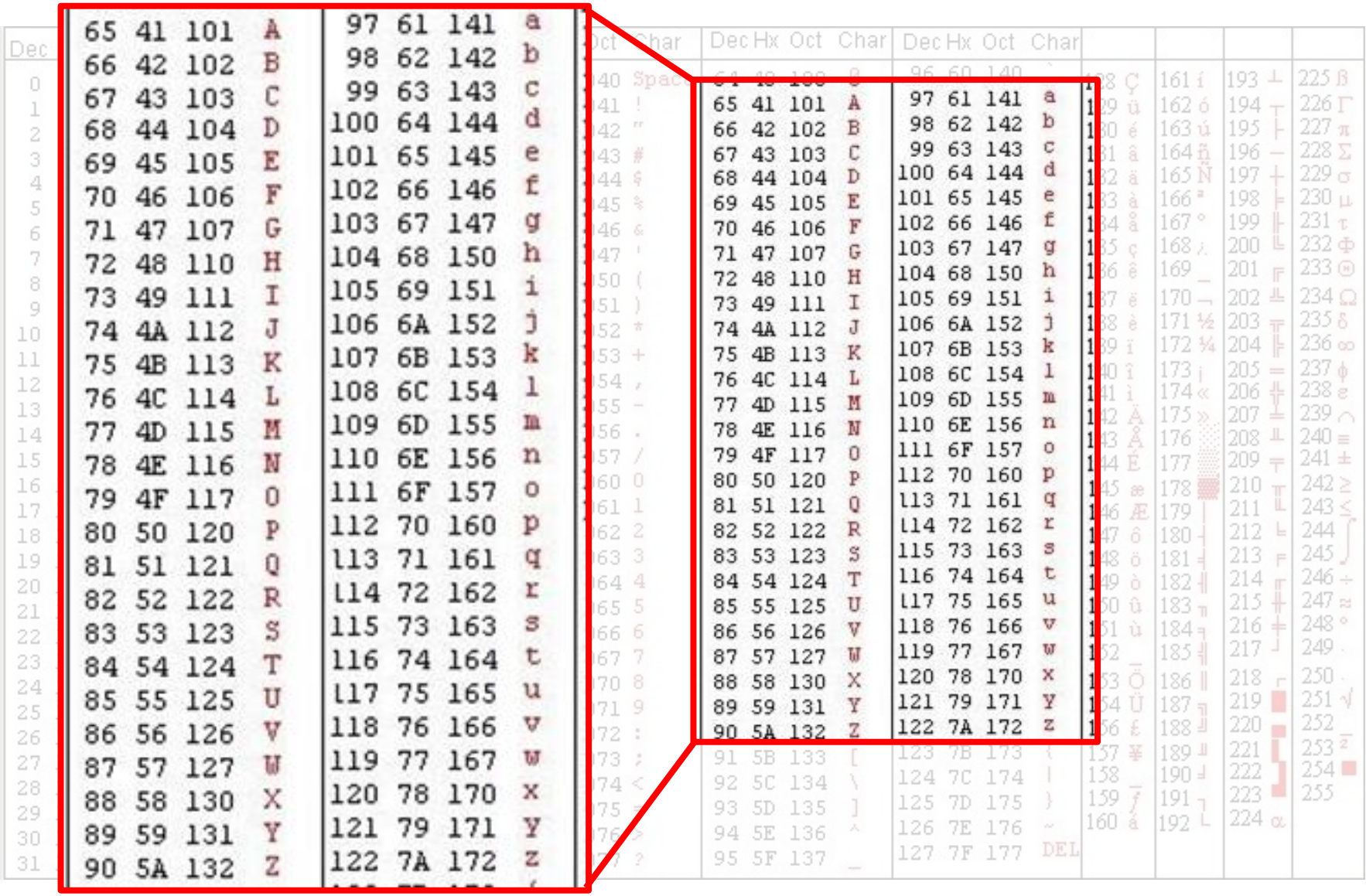
참고 : 데이타시트 https://ww1.microchip.com/downloads/en/DeviceDoc/Atmel-7810-Automotive-Microcontrollers-ATmega328P_Datasheet.pdf 147p

마이크로프로세서와 C언어 - ASCII

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

128 Ç	161 í	193 ┴	225 ß
129 ü	162 ó	194 ┬	226 Γ
130 é	163 ú	195 ├	227 π
131 â	164 ñ	196 ─	228 Σ
132 ä	165 Ñ	197 ┼	229 σ
133 à	166 ª	198 ╞	230 µ
134 å	167 º	199 ╟	231 τ
135 ç	168 ¿	200 ╚	232 Φ
136 ê	169 ⌐	201 ╔	233 Θ
137 ë	170 ¬	202 ╩	234 Ω
138 è	171 ½	203 ╦	235 δ
139 ï	172 ¼	204 ╠	236 ∞
140 î	173 ¡	205 ═	237 φ
141 ì	174 «	206 ╬	238 ε
142 Ä	175 »	207 ╧	239 ∩
143 Å	176 ░	208 ╨	240 ≡
144 É	177 ▒	209 ╤	241 ±
145 æ	178 ▓	210 ╥	242 ≥
146 Æ	179 |	211 ╙	243 ≤
147 ô	180 ┤	212 ╘	244 ⌠
148 ö	181 ╡	213 ╒	245 ⌡
149 ò	182 ╢	214 ╓	246 ÷
150 û	183 ╖	215 ╫	247 ≈
151 ù	184 ╕	216 ╪	248 °
152 ÿ	185 ╣	217 ┘	249 ∙
153 Ö	186 ║	218 ┌	250 ·
154 Ü	187 ╗	219 █	251 √
156 £	188 ╝	220 ▄	252 ⁿ
157 ¥	189 ╜	221 ▌	253 ²
158 ₧	190 ╛	222 ▐	254 ■
159 ƒ	191 ┐	223 ▀	255
160 á	192 └	224 α	

마이크로프로세서와 C언어 - ASCII



0x48
0x65
0x6C
0x6C
0x6F

아두이노를 이용한 시리얼통신 실험

- 예제2

```
int incomingByte = 0; // for incoming serial data

void setup()
{
  Serial.begin(9600); // opens serial port, sets data rate to 9600 bps
}

void loop()
{
  // send data only when you receive data:
  if (Serial.available()) {
    // read the incoming byte:
    incomingByte = Serial.read();

    // say what you got:
    Serial.print("I received: ");
    Serial.println(incomingByte, DEC);
  }
}
```

아두이노를 이용한 시리얼통신 실험

- 예제3

```
void setup()
{
  Serial.begin(9600); // opens serial port, sets data rate to 9600 bps
}

void loop()
{
    Serial.print(char(0x48));
    Serial.print(char(0x65));
    Serial.print(char(0x6c));
    Serial.print(char(0x6c));
    Serial.print(char(0x6f));

    delay(1000) ;
}
```