INDEX		GND,	291
		RESET,	292
		VCC,	291
		XTAL1 and XTAL2,	291
		AVR family,	49
		Classic AVR,	49
A		Mega AVR,	49
		Special purpose AVR,	50
ADC characteristics,	464	Tiny AVR,	49
analog input channels,	467	AVR fuse bits,	294
conversion time,	465	AVR fuse bits,	297
digital data output,	466	BODLEVEL,	297
end-of-conversion,	468	CKSEL0-CKSEL3,	295
parallel versus serial,	466	reset delay,	297
resolution,	465	AVR programming,	305
start conversion,	468	boot loader,	306
step size,	466	in-circuit serial programming,	305
$ m V_{ref}$,	465	parallel programming,	305
ADC hardware considerations,	469	AVR serial port,	405
ADC programming,	469	doubling the baud rate,	416
A/D conversion time,	475	FE and PE flag bits,	412
ADC input channel source,	472	interrupt-based data receive,	422
ADC Start Conversion bit,	474	interrupt-based data transmit,	423
ADCH: ADCL registers,	474	monitoring the UDRE flag,	412
ADCSRA register,	474	receive data serially,	413
ADLAR bit operation,	473	transfer data serially,	412
ADMUX register,	471	transmit and receive,	414
interrupts,	478	UBRR register,	405
polling,	476	UCSR registers,	408
sample-and-hold time,	476	UDR registers,	407
V _{ref} source,	47 1	AVR trainers,	306
addition,	6		
addition instruction,	162	В	
ADC,	163		
ADD,	162	back EMF,	496
addressing mode,	202	baud rate error calculation,	416
architectures,	32	big endian,	91
Harvard,	32	binary,	2
von Neumann,	32	binary logic,	9
ASCII character,	76	binary number,	76
ASCII code,	8	bipolar,	503
assembler,	- 80	bit,	13
assembler directive,	77	bit-wise operators in C,	265
ATmega pins,	290	branch penalty,	130
AREF,	291	BREQ,	112
AVCC,	291	BRNE,	108
		brown-out detector,	297

INDEX . 771

bus,	14	disabling interrupt,	366
address bus,	14	division,	167
control bus,	14	DPDT,	492
data bus,	14	DS1307 interfacing,	654
byte,	13	address map,	655
		control register,	656
C		reading from DS1307,	657
		register pointer,	657
C data types,	256	setting the time in Assembly,	658
signed int,	259	setting the time in C,	662
unsigned char,	257	writing to DS1307,	657
unsigned int,	259		
CALL,	118	E	
carry flag,	71		
choosing a microcontroller,	42	edge-triggered,	378
CISC,	94	EEPROM access in C,	284
compare instruction,	179	electromagnetic relay,	492
compare match,	328	electromechanical relay,	492
compiler,	80	embedded system,	41
conditional flag,	71	EMR,	492
context saving,	381	enabling interrupt,	366
converting between binary and hex,	4	EQU,	77
converting from binary to decimal,	3	extended I/O memory,	206
converting from decimal to binary,	2	external hardware interrupt,	376
converting from decimal to hex,	4		
converting from hex to decimal,	5	F	
counter,	348	_	
CPU architecture,	29	Fast PWM,	561,574
CTC,	328	flag register,	71
,		flip-flop,	12
D			
DAG SANGONIO	484	G	
DAC interfacing,	485	annual mumaga ragistar	56
converting Iout to voltage,		general purpose register,	516
DAC0808,	485	generating pulses,	13
generating a stair-step ramp,	486	gigabyte,	13
MC1408,	485	**	
programming DAC in C,	486	Н	
data memory,	59	1 10 0	70
DC motors,	550-553	half carry flag,	72 502
bidirectional control,	550-553	half-stepping,	502
pulse width modulation,	556	Harvard architecture,	90
unidirectional control,	550	hex number,	75
decimal,	2	hexadecimal,	4
decimal number,	76	HIGH(),	201
decoder,	12	holding torque,	502
direct addressing,	204		

I		LCD pin descriptions,	430
		D0-D7,	431
I/O direct addressing,	205	E, enable,	430
I/O memory,	59	R/W, read/write,	430
I/O port pins and their functions,	140	RS, register select,	430
I/O register,	205	VCC, VSS, and VEE,	430
I2C bus protocol,	630	sending commands to the LCD,	432
bit format,	631	sending data to the LCD,	432
clock stretching,	636	LDI,	57
line electrical characteristics,	630	LDS,	62
nodes,	631	level-triggered,	378
packet format,	633	little endian,	91
address packet format,	633	logic gates,	9
arbitration,	636	AND gate,	9
data packet format,	634	inverter,	10
SLA+R,	634	NAND gate,	10
SLA+W,	634	NOR gate,	10
START and STOP conditions,	631	OR gate,	9
ICALL,	126	tri-state buffer,	9
IJMP,	117	XOR gate,	10
immediate addressing,	203	logic instructions,	176
IN,	64	AND,	176
INCLUDE,	78	COM,	179
input capture,	531	EX-OR,	177
instruction cycle time,	130	NEG,	179
Intel Hex,	300	OR,	176
interrupt,	364	loop,	108
interrupt handler,	364	LOW(),	201
interrupt latency,	384	lst file,	83
interrupt priority,	381	,	
interrupt service routine,	364	M	
interrupt vector table,	365	141	
inverted,	567,577	machine cycle,	130
		machine language,	80
J		map file,	83
		MAX232,	403
JMP,	116	MAX233,	404
		MAX7221 interfacing,	615
K		7-segment display,	615
		data packet format,	617
kilobyte,	13	MAX7221 pins,	616
		CLK,	616
L	•	CS,	616
		DIG0-DIG7,	616
LCD interfacing,	430	DIN,	616
4-bit interfacing,	434	DOUT,	616
initializing the LCD,	432	GND,	616

INDEX . 773

ISET,	616	DDR for outputting data,	142
SEGA-SEGG and DP,	617	PIN register role in inputting data,	, 143
VCC,	616	Port A,	144
programming in Assembly,	621	Port B,	145
programming in C,	624	Port C,	146
measuring period,	534	Port D,	146
measuring pulse width,	536	PORT register	143
megabyte,	13	SBIC (Skip if Bit in I/O register	
microcontroller,	40	Cleared),	154
microprocessor,	40	SBIS (Skip if Bit in I/O register	
mnemonic,	80	Set),	153
MOV,	67	synchronizer delay,	145
multiplication,	166	prescaler,	345
multistage execution,	129	program counter,	85
		PWM,	556,560
N			
		R	
NC,	492		
negative flag,	71	RAM,	20
nested loop,	110	DRAM,	23
nested loop delay,	133	NV-RAM,	22
nibble,	13	SRAM,	21
NO,	492	RCALL,	124
non-inverted,	566,576	reed switch,	496
Normal mode,	317	relay,	492
normally closed,	492	RISC,	93
normally open,	492	RJMP,	117
numbering and coding systems,	2	ROM,	16
		EEPROM,	19
0		EPROM,	17
		Flash memory,	19
operators in C,	271	Mask ROM,	20
bit-wise shift operation,	272	PROM,	16
compound assignment,	271	RPM,	501
optoisolator,	496	RS232 pins,	399
ORG,	78	CTS,	401
oscillator clock source,	295	DCD,	401
OUT,	67	DSR,	401
overflow flag,	71	DTR,	401
		RI,	401
P		RTS,	401
Dhoce correct DWM	566, 585	S	
Phase correct PWM,	128	S	
pipelining, polling,	364	sensor interfacing,	480
_	140	interfacing the LM35,	481
port programming, DDR for inputting data,	142	LM34 and LM35,	480
DDK for inputting data,	172	MITTED I MILL MITTED 9	

reading temperature,	482	steps per revolution,	499
sensors,	480	STS,	63
transducers,	480	subtract instruction,	164
serial communication,	396	SBC,	166
framing,	398	SBIW,	165
full-duplex,	397	SUB,	164
half-duplex,	397	SUBI,	165
modem,	397	subtraction,	7
space,	398	Successive Approximation,	468
transfer rate,	399		
SET,	77	T	
SFR,	60		
short jump,	114	task switching,	381
sign bit,	72	TIFR,	316
single-register addressing,	203	time delay in C,	261
solid-state relay,	495	timer interrupt,	369
SPDT,	492	Timer0,	315
special function register,	60	Timer1,	335
SPI bus protocol,	604	Timer2,	332
3-wire interface bus,	604	TWI programming,	642
clock polarity and phase,	606	checking status register,	668
СРНА,	606	master receiver operating	
CPOL,	606	mode,	674
how SPI works,	605	master transmitter operating	
reading data,	608	mode,	668
multibyte burst read,	608	slave receiver operating mode,	686
single-byte read,	608	slave transmitter operating	
writing data,	606	mode,	680
multibyte burst write,	607	master operating mode,	642
single-byte write,	607	slave operating mode,	648
SPI programming,	609	TWI registers,	638
master operating mode,	612	TWI Address Register (TWAR),	641
programming in C,	614	TWI Bit Rate Register (TWBR),	639
slave operating mode,	613	TWI Control Register (TWCR),	640
SPCR (SPI Control Register),	610	TWI Data Register (TWDR),	641
SPDR (SPI Data Register),	611	TWI Interrupt (TWINT) flag,	640
SPSR (SPI Status Register),	609	TWI Status Register (TWSR),	639
SS pin,	611	two-register addressing,	203
SPST,	492		
stack,	119	U	
initializing the stack,	121		
POP,	119	unconditional branch,	116
PUSH,	119	unipolar,	503
stack pointer,	119		
status register,	71	\mathbf{V}	
step angle,	499		
stepper motor,	498	von Neumann,	32

INDEX . 775

W

waveform generator, 510

Z

zero flag, 71