

CDS 130-001 Computing for Scientists

Midterm Exam Review

Oct. 13, 2010

1. Review Sheet

2. Sample Midterm Exam

CDS 130-003 Computing for Scientists

Midterm Exam - Review Sheet

Oct. 13, 2010

The following is a complete list of topics that will be covered in the midterm exam.

Section I: Computer Fundamentals (CF) (PPT Slides, all from 1-131)

CF-1: Binary Representation and Operation

- Binary Positional Notation
- Binary to Decimal Conversion: Template Method
- Decimal to Binary Conversion: Template Method
- Decimal to Binary Conversion: Long Division Method
- Octal Numeral System; Hexadecimal Numeral System

- Binary Addition
- Binary Subtraction
- Binary Multiplication

CF-3: Data Storage and Binary Encoding

- Devices Storing Binary Data
- Bits, Bit Pattern, Bytes
- ASCII Code, ASCII Table
- Encoding ASCII Characters to Binary Sequences
- Decoding Binary Sequences to ASCII Characters

CF-4: Logic Circuits and Logic Tables

- Transistor: the building block
- AND gate, AND table
- OR gate, OR table
- NOT gate, NOT table
- NAND gate, NAND table
- NOR gate, NOR table
- XOR gate, XOR table
- Logic Circuits with Three Inputs
- Binary Number Adding Machine

Section II: Scientific Simulation (SS) (PPT Slides, from 1-63)

SS-1: Introduction

SS-2: Mathematical Model (and MATLAB Programming)

- The Pipeline of Scientific Model, Mathematical Model and Computational Model
- Converting Scientific Model to Mathematical Model
- Computational Model Implementation Using MATLAB: FOR LOOP
- Predator-Prey Model: two unknowns
- MATLAB: the usage of "plot" function

Tool: Introduction to MATLAB (MT) (PPT/PDF Slides 1- 156)

CH-1: Prologue

CH-2: The MATLAB Environment

CH-3: Assignments, Variables and Intrinsic Functions

CH-4: Vectors and Vector Operations

CH-5: Matrices (Arrays) and Matrix Operations

CH-6: Iteration 1: For Loops

CH-7: Write a Program

CH-8: Basic Graphs and Plots

CDS 130-003 Computing for Scientists

Midterm Exam - Sample Midterm Exam

Oct. 13, 2010

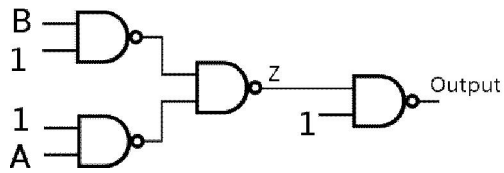
This is a closed-book closed-computer exam. Calculators are allowed. Your answer should be on the space provided immediately following each question on the exam sheets.

1. Convert 1111_2 to its base ten equivalent using the template method
 2. Convert 79_{10} to its binary equivalent using either the template method or long-division method.
 3. Carry out the binary addition of $10111_2 + 01001_2$? Keep your answer in binary format
 4. Carry out the binary subtraction of $10111_2 - 01001_2$? Keep your answer in binary format
 5. Carry out the binary multiplication of $110_2 \times 101_2$? Keep your answer in binary format
 6. What is the decimal value of 465_8 ?
-

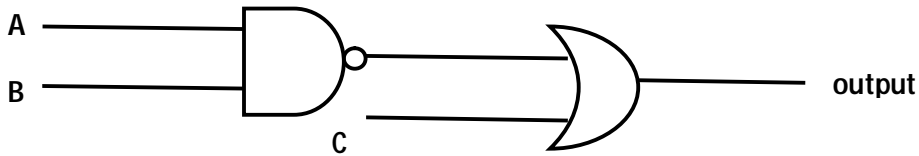
7. What is the decimal value of character "B" in ASCII table? What is the binary number of "B"?

8. Use ASCII code to encode the string "ASCII" into a binary sequence. Note that each character corresponds to 8 bits in binary number.

9. In the image below, four NANDS are connected and three of the inputs are set to 1. What are the values of Z and output if B = 1 and A = 0?



10. Fill out the logic table corresponding to the Logic Circuit shown below, which consists of a NAND gate and an OR gate. Show all input bit pattern combinations A, B and C in the table. For each input bit pattern combination, calculate the corresponding output.



A	B	C	Output

11. In a 7 bit analog to digital converter, how many different levels of data can be recorded?

12 For the matrix "A" shown below

12	4	5
1	7	6
32	23	9

(1) How many rows and columns in this matrix?

(2) What is value of A(2,1)?

(3) What is value of A (1,3)?

(4) What is value of A(2,2)+A(3,1)?

12. Considering the following iteration code, what is A(4)?

```
A(1)=13;  
for i=[2:4]  
    A(i)=A(i-1)+37;  
end
```

13. Considering the following iteration code, what is A after the FOR loop?

```
A(1)=0  
for i=[1:5]  
    A(i+1)=A(i)+i^2;  
end
```

The following statement is used for question 14, 15

My bank offers 5% interest on my account compounded yearly. Every year I deposit an additional \$100. Assuming that on the first year your account had a balance of \$100.

14. Translate the above statement into a mathematical model

15. Translate your mathematical model into MATLAB programming code. Your code should be able to calculate the balance from year 1 to year 10. There is no need of doing the calculation in the exam. Only MATLAB code is needed.

Information Sheet

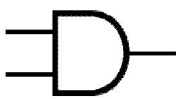
1. ASCII Table

Dec	Hx	Oct	Char	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr
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	A	97	61	141	a	a
2	2	002	STX (start of text)	34	22	042	"	"	66	42	102	B	B	98	62	142	b	b
3	3	003	ETX (end of text)	35	23	043	#	#	67	43	103	C	C	99	63	143	c	c
4	4	004	EOT (end of transmission)	36	24	044	$	\$	68	44	104	D	D	100	64	144	d	d
5	5	005	ENQ (enquiry)	37	25	045	%	%	69	45	105	E	E	101	65	145	e	e
6	6	006	ACK (acknowledge)	38	26	046	&	&	70	46	106	F	F	102	66	146	f	f
7	7	007	BEL (bell)	39	27	047	'	'	71	47	107	G	G	103	67	147	g	g
8	8	010	BS (backspace)	40	28	050	((72	48	110	H	H	104	68	150	h	h
9	9	011	TAB (horizontal tab)	41	29	051))	73	49	111	I	I	105	69	151	i	i
10	A	012	LF (NL line feed, new line)	42	2A	052	*	*	74	4A	112	J	J	106	6A	152	j	j
11	B	013	VT (vertical tab)	43	2B	053	+	+	75	4B	113	K	K	107	6B	153	k	k
12	C	014	FF (NP form feed, new page)	44	2C	054	,	,	76	4C	114	L	L	108	6C	154	l	l
13	D	015	CR (carriage return)	45	2D	055	-	-	77	4D	115	M	M	109	6D	155	m	m
14	E	016	SO (shift out)	46	2E	056	.	.	78	4E	116	N	N	110	6E	156	n	n
15	F	017	SI (shift in)	47	2F	057	/	/	79	4F	117	O	O	111	6F	157	o	o
16	10	020	DLE (data link escape)	48	30	060	0	0	80	50	120	P	P	112	70	160	p	p
17	11	021	DC1 (device control 1)	49	31	061	1	1	81	51	121	Q	Q	113	71	161	q	q
18	12	022	DC2 (device control 2)	50	32	062	2	2	82	52	122	R	R	114	72	162	r	r
19	13	023	DC3 (device control 3)	51	33	063	3	3	83	53	123	S	S	115	73	163	s	s
20	14	024	DC4 (device control 4)	52	34	064	4	4	84	54	124	T	T	116	74	164	t	t
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
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

Source: www.LookupTables.com


2. Logical Gates and Tables

AND



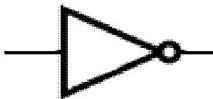
INPUT		OUTPUT
A	B	A AND B
0	0	0
0	1	0
1	0	0
1	1	1

OR




INPUT		OUTPUT
A	B	A OR B
0	0	0
0	1	1
1	0	1
1	1	1

NOT




INPUT	OUTPUT
A	NOT A
0	1
1	0

NAND




INPUT		OUTPUT
A	B	A NAND B
0	0	1
0	1	1
1	0	1
1	1	0

NOR



INPUT		OUTPUT
A	B	A NOR B
0	0	1
0	1	0
1	0	0
1	1	0

XOR



INPUT		OUTPUT
A	B	A XOR B
0	0	0
0	1	1
1	0	1
1	1	0