THE UNIVERSITY OF AUCKLAND

SECOND SEMESTER, 2011
Campus: City

Computer Science

TEST

Modern Data Communications

(Time Allowed: 45 MINUTES)

Note:

- The use of calculators is NOT permitted.
- Compare the exam version number on the Teleform sheet supplied with the version number above. If they do not match, ask the exam supervisor for a new sheet.
- Enter your name and student ID on the Teleform sheet. Your name should be entered left aligned. If you name is longer than the number of boxes provided, truncate it.
- Answer ALL **Multiple-choice** questions on the Teleform answer sheet provided.
- Use a dark pencil to mark your answers in the multiple choice answer boxes on the Teleform sheet. Check that the question number on the sheet corresponds to the question number in this question/answer book. If you spoil your sheet, ask the supervisor for a replacement.
- An appendix is included on the last page. You may detach this appendix.

Question 1
[1 mark] A prefix code is a code

(a) in which no codeword is a proper prefix of the smallest length codeword.
(b) in which no codeword is a proper prefix of itself.
(c) in which no codeword is a proper prefix of another codeword.
(d) in which some codewords are not proper prefixes of some codewords.
(e) in which some codewords are not proper prefixes of all codewords.

Question 2
[1 mark] The assignment 1= *a*, 01= *b*, 001= *c*, 1000 = *d*

(a) is not a prefix code because the codeword of *b* is a prefix of the codeword of *c*.
(b) is a prefix code because all codewords have different length.
(c) is not a prefix code because the codewords do not have the same length.
(d) is a prefix code because the codeword of *b* is not a prefix of any codeword.
(e) is not a prefix code because the codeword of *a* is a prefix of the codeword of *d*.

Question 3
[2 marks] Which one among the following statements is NOT true in general?

(a) Some finite codes are uniquely decodable.
(b) Every prefix code is uniquely decodable.
(c) Some uniquely decodable codes are prefix codes.
(d) Every fixed-length code is a prefix code.
(e) Every uniquely decodable code is a prefix code.

Question 4
[2 marks] Using the Baudot code, the bit string 11111 00011 11001 01110 11011 10111 10011 00001 is coded into

(a) 321CBA.
(b) ABC321.
(c) ABC123.
(d) 123ABC.
(e) 321ABC.

Question 5
[1 mark] All ASCII codewords have the same length, so ASCII

(a) is an infinite code.
(b) is not a code.
(c) has only 64 codewords.
(d) is a prefix code.
(e) is not uniquely decodable.

Question 6
[1 mark] A higher-bandwidth channel

(a) has an infinite bit rate.
(b) has a lower bit rate.
(c) cannot have a higher bit rate.
(d) has a higher bit rate.
(e) has zero bit rate.

Question 7
[1 mark] The process of extracting the data from a modulated signal is called

(a) compression.
(b) discretization.
(c) encoding.
(d) demodulation.
(e) modulation.

Question 8
[1 mark] According to Nyquist theorem, in a distortion-free transmission, the baud rate is

(a) four times the maximum frequency of the medium.
(b) at most twice the maximum frequency of the medium.
(c) the maximum frequency of the medium.
(d) half the maximum frequency of the medium.
(e) three times the maximum frequency of the medium.

Question 9
[1 mark] In a distortion-free telephone transmission (where the maximum frequency is 3300 HZ) in which each symbol carries 4 bits, the bit rate is at most

(a) 13200.
(b) 26400.
(c) 19200.
(d) 6600.
(e) 3300.

Question 10
[2 marks] The numbers 10,2,5:

(a) the numbers do not satisfy Kraft's inequality.
(b) satisfy Kraft's inequality and the prefix code produced by Kraft's theorem is 00, 01000, 0100100000
(c) satisfy Kraft's inequality and the prefix code produced by Kraft's theorem is 00, 0100, 10000000000.
(d) satisfy Kraft's inequality and the prefix code produced by Kraft's theorem is 00, 01000, 0100000000.
(e) satisfy Kraft's inequality and the prefix code produced by Kraft's theorem is 10, 01000, 1000000000.

Question 11
[2 marks] Which of the following codewords is a correct Huffman set of codewords for the letters A, B, C, D, E having frequencies 15%, 15%, 10%, 10%, 50%?

(a) A= 101, B=100, C=111, D=110, E=000.
(b) A= 101, B=100, C=111, D=110, E=0.
(c) A= 0, B=100, C=111, D=110, E=101.
(d) A= 101, B=100, C=111, D=0, E=0.
(e) A= 101, B=100, C=111, D=110, E=10.

Rough Working – This page will not be marked

APPENDIX

Base Conversion Table and Powers of two

Decimal	Hexadecimal	Binary	2^n Hex	2^n Decimal
0	0	0000	1	1
1	1	0001	2	2
2	2	0010	4	4
3	3	0011	8	8
4	4	0100	10	16
5	5	0101	20	32
6	6	0110	40	64
7	7	0111	80	128
8	8	1000	100	256
9	9	1001	200	512
10	a	1010	400	1024
11	b	1011	800	2048
12	c	1100	1000	4096
13	d	1101	2000	8192
14	e	1110	4000	16384
15	f	1111	8000	32768

Table E.2 The Standard ASCII Table

ASCII			ASCII			ASCII			ASCII		
Character	Dec	Hex	Character	Dec	Hex	Character	Dec	Hex	Character	Dec	Hex
nul	0	00	sp	32	20	@	64	40	`	96	60
soh	1	01	!	33	21	A	65	41	a	97	61
stx	2	02	"	34	22	B	66	42	b	98	62
etx	3	03	#	35	23	C	67	43	c	99	63
eot	4	04	$	36	24	D	68	44	d	100	64
enq	5	05	%	37	25	E	69	45	e	101	65
ack	6	06	&	38	26	F	70	46	f	102	66
bel	7	07	'	39	27	G	71	47	g	103	67
bs	8	08	(	40	28	H	72	48	h	104	68
ht	9	09	)	41	29	I	73	49	i	105	69
lf	10	0A	*	42	2A	J	74	4A	j	106	6A
vt	11	0B	+	43	2B	K	75	4B	k	107	6B
ff	12	0C	'	44	2C	L	76	4C	l	108	6C
cr	13	0D	-	45	2D	M	77	4D	m	109	6D
so	14	0E	.	46	2E	N	78	4E	n	110	6E
si	15	0F	/	47	2F	O	79	4F	o	111	6F
dle	16	10	0	48	30	P	80	50	p	112	70
dc1	17	11	1	49	31	Q	81	51	q	113	71
dc2	18	12	2	50	32	R	82	52	r	114	72
dc3	19	13	3	51	33	S	83	53	s	115	73
dc4	20	14	4	52	34	T	84	54	t	116	74
nak	21	15	5	53	35	U	85	55	u	117	75
syn	22	16	6	54	36	V	86	56	v	118	76
etb	23	17	7	55	37	W	87	57	w	119	77
can	24	18	8	56	38	X	88	58	x	120	78
em	25	19	9	57	39	Y	89	59	y	121	79
sub	26	1A	:	58	3A	Z	90	5A	z	122	7A
esc	27	1B	;	59	3B	[	91	5B	{	123	7B
fs	28	1C	<	60	3C	\	92	5C	|	124	7C
gs	29	1D	=	61	3D	]	93	5D	}	125	7D
rs	30	1E	>	62	3E	^	94	5E	~	126	7E
us	31	1F	?	63	3F	_	95	5F	del	127	7F