DATA COMMUNICATION – EDA415

Solution to Final Exam 23 May 2000

Problem 1

a) False. Lecture 3, slide 10

b) False. Lecture 4, slide 12

c) False. Lecture 6, slide 16

d) True. Lecture 10, slide 26

e) False. Lecture 12, slide 7

f) True. Lecture 13, slide 11

Problem 2

a) Lecture 12, slide 3.

b) Lecture 12, slide 7.

c) Lecture 12, slides 14-15.

d) Lecture 12, slide 17 and lecture 10, slide 8.
Tanenbaum pp. 527–528, pp. 538–539.

Problem 3

a) Lecture 5, slide 19.

b) Lecture 5, slides 19–20.

c) Lecture 5, slides 22–23. There are 4 check bits per codeword.
The message polynomial is

$$a(x) = x^5 + x^2 + x + 1$$

The CRC check bits are the remainder of $(a(x) \cdot x^4)/g(x)$.

$$\frac{a(x) \cdot x^4}{g(x)} = \frac{x^9 + x^6 + x^5 + x^4}{x^4 + x + 1} = x^5 + 1 + \frac{x + 1}{x^4 + x + 1}$$

So the codeword is

$$c(x) = x^9 + x^6 + x^5 + x^4 + x + 1 = 1001110011$$

d) Lecture 5, slide 23.

Problem 4

a) Lecture 8, slides 2–3.
Tanenbaum pp. 252–255, pp. 288–289, pp. 292–293.

b) Lecture 8, slides 2 and 4–5, lecture 7, slide 20

c) Lecture 8, slide 5.

$$\frac{8 \cdot 64 \text{ bits}}{10 \text{ Mbits}} \text{ s} = 51.2 \cdot 10^{-6} \text{ s}$$

$$t_p = \frac{51.2 \cdot 10^{-6}}{2} \text{ s} = 25.6 \cdot 10^{-6} \text{ s}$$

Problem 5

a) Lecture 13, slide 4

b) "if I can decrypt this message I get two marks"

S	O	U	T	H	P	A	R	K
7	4	9	8	2	5	1	6	3
i	f	i	c	a	n	d	e	c
r	y	p	t	t	h	i	s	m
e	s	s	a	g	e	i	g	e
t	t	w	o	m	a	r	k	s

c) Lecture 13, slides 6 and 9.
Secret key systems: DES, IDEA.
Public key systems: RSA.

d) Tanenbaum pp. 664–666.

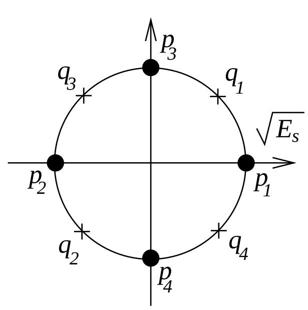
Problem 6

a) Lecture 2, slide 4.

b) Lecture 4, slide 3–4.

c)

$$\begin{array}{ll}
p_1(t) \Rightarrow p_1 & (\sqrt{2}/2)(p_1(t) + p_3(t)) \Rightarrow q_1 \\
p_2(t) \Rightarrow p_2 & (\sqrt{2}/2)(p_2(t) + p_4(t)) \Rightarrow q_2 \\
p_3(t) \Rightarrow p_3 & (\sqrt{2}/2)(p_2(t) + p_3(t)) \Rightarrow q_3 \\
p_4(t) \Rightarrow p_4 & (\sqrt{2}/2)(p_1(t) + p_4(t)) \Rightarrow q_4
\end{array}$$



d) Lecture 4, slide 12, lecture 2, slide 14.

Problem 7

a) Lecture 13, slide 20, Tanenbaum pp. 38–44, pp. 63–65.

b) Lecture 9, slides 21-22.

c) Lecture 9, slide 23.

from A to

A	10	B
B	6	B
C	8	B
D	7	D
E	8	E
F	0	-

updated routing table

d) Lecture 10, slide 22.
