The University of Auckland

Department of Computer Science

COMPSCI 314 S1 C : Assignment 1.

Due : Thursday 11 March 2004, 4 pm.

- This assignment will contribute 5/30 of the coursework mark and 5% of the overall course mark .

Q 1 Shay Rv1 What is the difference between contention and collision? **[2 marks]**

- Contention occurs whenever two or more stations compete for the right to transmit on a single medium. Somehow, one eventually gains the right to transmit. [1 mark]
- A collision is the result of two devices on the same network attempting to transmit data at the same time. The network detects the "collision" of the two transmitted packets and uses method (such as CSMA/CD) of allowing devices to "take turns" using the signal carrier line. [1 mark]
  (On Ethernet or IEEE 802.3, a collision is a part of contention; other networks contend without collisions.)

Q 2 Shay Rv16 Distinguish between upward and downward multiplexing. [2 marks]

- Upward multiplexing occurs whenever two or more services combine for transmission over a single lower-level channel. It is so frequent that we seldom think about it and means that a single carrier can be shared among many users.
  [1 mark]
- Downward multiplexing involves splitting a single user service among several circuits available, but each one has limited capacity or low data rate. It is used especially in sliding-window protocols over satellite links or other long-distance circuits.
  [1 mark]

[This question was first deleted, but then restored as 2 possible bonus marks.]

Q 3 Shay Ex6 In Figure 1.20, list all the routes through which node C can communicate with node D, *giving the cost of each route*. (Assume a route does not pass through a node more than once.) **[4 marks]**

Path	Cost
CABD	15
CABEFD	25
CABFD	25
CEBD	14
CEBFD	24
CEFBD	24
CEFD	18
CFBD	20
CFD	14
CFEBD	20

10 routes; deduct 0.5 mark for each missed route

Q 4 Describe how parity is generated and used **[4 marks]**

- Parity refers to a technique of checking whether data has been lost or written over when it's moved from one place in storage to another or when transmitted between computers. Parity checking can be selected to be even or odd.
[1 mark]

- An additional binary digit, the *parity bit*, is added to a group of bits. This bit is used only for the purpose of identifying whether the bits being moved arrived successfully. Before the bits are sent, they are counted and if the total number of data bits is even, the parity bit is set to one so that the total number of bits transmitted will form an odd number. If the total number of data bits is already an odd number, the parity bit remains or is set to 0. (This example assumes *odd parity*; for *even parity* the value of the parity bit is reversed.)
[2 mark]
- At the receiving end, each group of incoming bits is checked to see if the group totals to an odd number. If the total is even, a transmission error has occurred and either the transmission is retried or the system halts and an error message is sent to the user.
[1 mark]

Q 5 Shay Ex9 Explain when a single parity bit *will detect errors* and when it *will not detect errors*. **[4 marks]**

Parity bit checking is not an infallible error-checking method; it can detect odd numbers of bits in error but not even numbers of bit errors. E.g. four bits in the data stream can be in error, and parity bit checking will not detect this errors.

Q 6 Shay Ex7 Consider the following frames

011010111110001	x
101101000101101	x
101010100001000	x

Suppose x is the parity bit for each frame.
What must x be to establish even parity?
Odd parity? (6 values in total.) **[3 marks]**

	Even	Odd
011010111110001	1	0
101101000101101	0	1
101010100001000	1	0

Half mark for each value

Q 7 Shay Ex14 How many direct connections would there be in a fully connected topology (or network) containing n nodes? **[2 marks]**

Each of the n nodes can connect to the $(n-1)$ other nodes, for a total of $n(n-1)$ connections.
But this counts each link twice (such as A to B and B to A) so the total number of connections is half this or $^{n(n-1)}/_{2}$.

Q 8

For this question, read about geosynchronous communication satellites in Chapter 2.

(a) Why is a satellite called "geosynchronous", and what are the special advantages for communications of such satellites ? **[2 marks]**

"Geo" means "Earth", and the satellite's orbit is synchronised with the Earth's rotation.
The satellite appears always in the same position in the sky and can be pointed to by a large fixed antenna, with guaranteed service. Satellites in other orbits are visible for only some of the time.

(b) For geosynchronous satellites as in the diagram over the page, if A sends a message to B, what is the least time that station A would have to wait for a reply from station B, and similarly sending to and getting a reply from station C? (*Assume that A can communicate with C through B.*)

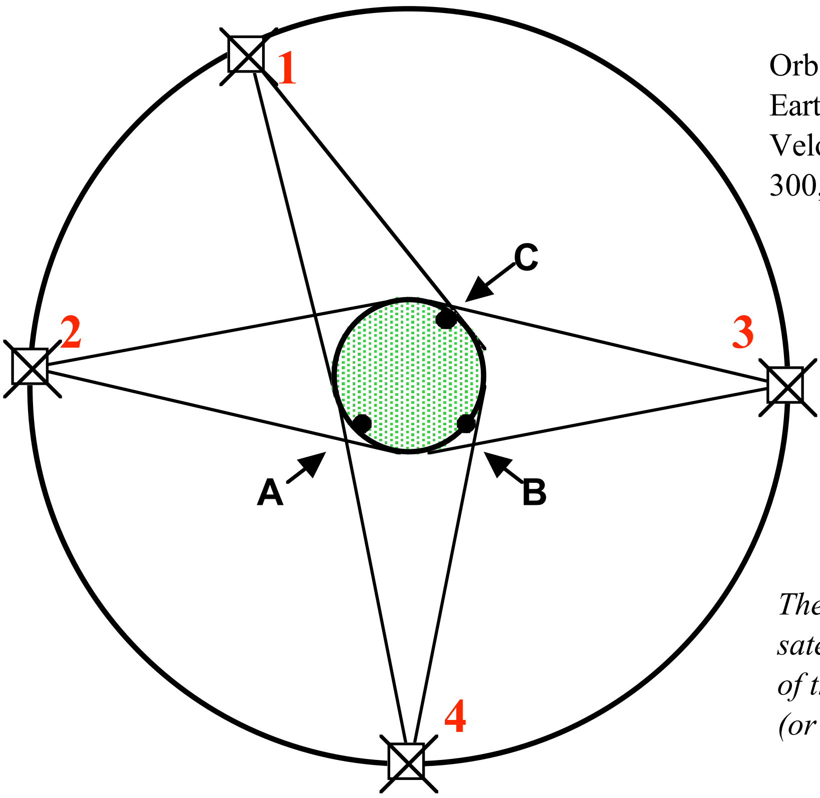
[4 marks]

Assume that the distance from any earth station to a satellite is always the same as the orbital radius, 36,000 km. (The diagram has been extended to number the satellites.)

• For A to get a reply from B, it must send a message to satellite 4 which then sends the message on to B; B must then reply via the same satellite. There are 4 earth-satellite paths (A–4, 4–B, B–4, 4–A), with a total distance of 144,000 km. As radio signals travel at 300,000 km/s, the total propagation delay is $^{144000}/_{300000}$ = <u>0.48 seconds</u>.

• A must communicate with C by using B asa relay.. Thus messages go A–B and then B–C, and back over the reverse, double-hop, path. The time for a reply is now twice that with only A and B, or <u>0.96 seconds</u>

Total = 25 marks



Orbital radius = 36,000 km
Earth radius is negligible
Velocity of radio signals
300,000 km/s

The lines from each satellite show which parts of the earth they can "see" (or can see them).

Here is “Figure 1.20 Route Costs” from Shay 2nd Edition
(It is Figure 1.19 in the 3rd edition).