

Midterm 2

Link layer

CRC checksums

- Pad a bit string with a sequence of digits that makes it divisible by a generator polynomial.
- Example:

$$x^3 + x^2 + 1 \rightarrow 1x^3 + 1x^2 + 0x + 1$$

$$\begin{array}{c} \downarrow \\ 1101 \\ \hline \end{array}$$

denom

Encode: 101101101 - length n

$$\begin{array}{r|l} 1101 & 101101101000 \leftarrow \text{length } n-1 \\ \hline & \begin{array}{r} 1101 \downarrow \\ \hline 1100 \\ 1101 \downarrow \downarrow \\ \hline 1110 \\ 1101 \downarrow \downarrow \\ \hline 1110 \\ 1101 \downarrow \downarrow \\ \hline 1100 \\ 1101 \downarrow \downarrow \\ \hline 001 \end{array} \end{array}$$

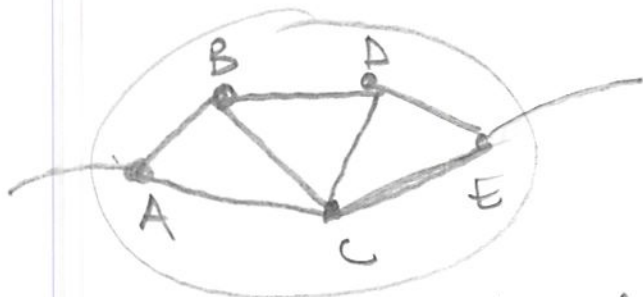
encoded: 101101101001

- Should be divisible by generator polynomial

$$\begin{array}{r}
 1101 \mid 101101101 \mid 001 \\
 \underline{1101} \downarrow \\
 1100 \downarrow \\
 1101 \downarrow \\
 \underline{1110} \downarrow \\
 1101 \downarrow \\
 \underline{1110} \downarrow \\
 1101 \downarrow \\
 \underline{1101} \downarrow \\
 1101 \downarrow \\
 \underline{1101} \\
 0 \rightarrow \text{no error}
 \end{array}$$

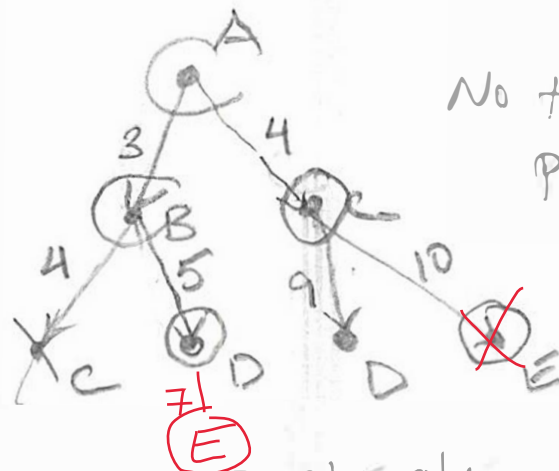
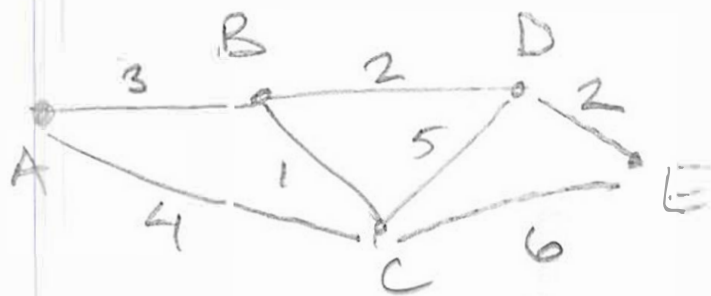
Network Layer

- Interior gateway protocols develop a sink tree over a subnet



- Packet needs to travel from A to E
- How can?
- Link state packets broadcast delays

| A | B | C | D | E |
|-------|-------|-------|-------|-------|
| SEQ | SEQ | SEQ | SEQ | SEQ |
| Age | Age | Age | Age | Age |
| Last | Last | Last | Last | Last |
| B 3 | A 3 | A 4 | B 2 | C 6 |
| C 4 | C 1 | B 1 | C 5 | D 2 |
| | D 2 | D 5 | E 2 | |



No tie breaker, just pick randomly

Exterior Gateway protocols

- Routing mostly based on network address prefixes

IPv4: 32 bits, organized into bytes and shared as 4 decimal numbers

7.163.102.97

$\begin{matrix} \swarrow & \downarrow & \searrow & \nearrow \\ 4+2+1 & 128+32+2+1 & 64+32+4+2 & 64+32+1 \end{matrix}$
 0000 0111.1010 0011.0110 0110.0110 0001

The subnet mask masks the bits belonging to the network. Example

7.163.102.97 / 15 \rightarrow 15 MSB masked

\downarrow
 1111 1111.1111 1110.0000 0000.0000 0000
 255.254.0.0

What is the host address?

0000 0000.0000 0001.0110 0110.0110 0001
 \uparrow
 start here = 0.0.102.97