Ch 12 : Bellman-Ford Standard Solution

Find least cost path with node A as a source

<table>
<thead>
<tr>
<th>h</th>
<th>B path</th>
<th>C path</th>
<th>D path</th>
<th>E path</th>
<th>F path</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
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<td>1</td>
<td>AB</td>
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<td>4</td>
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<tr>
<td>2</td>
<td>1</td>
<td>AB</td>
<td>4</td>
<td>ABC</td>
<td>4</td>
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<td>3</td>
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<td>ABEC</td>
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Chapter 13

Review Question : 13.3. Give a brief explanation of each of the congestion control techniques illustrated in Figure 13.5.
**Backpressure**: involves link-by-link use of flow control in a direction toward the source (fluid)

**Choke packet**: control packet generated at a congested node and transmitted back to a source node to restrict traffic flow.

**Implicit congestion signaling**: source feels the increasing delays and reduce transmission rate.

**Explicit congestion signaling**:
- **Backward**: congestion avoidance procedures should be initiated where applicable for traffic in the opposite direction of the received notification. It indicates that the packets that the user transmits on this logical connection may encounter congested resources.
- **Forward**: Notifies the user that congestion avoidance procedures should be initiated where applicable for traffic in the same direction as the received notification. It indicates that this packet, on this logical connection, has encountered congested resources.
- **Credit based**: These schemes are based on providing an explicit credit to a source over a logical connection.
- **Rate based**: These schemes are based on providing an explicit data rate limit to the source over a logical connection.

**Traffic Rate Management in frame-relay network**

**committed information rate (CIR)**: This is a rate, in bits per second, that the network agrees to support for a particular frame-mode connection. Any data transmitted in excess of the CIR are vulnerable to discard in the event of congestion

**discard eligibility (DE) bit**: If the rate exceeds the CIR, the incoming frame handler will set the DE bit. on the excess frames and then forward them; such frames may get through or may be discarded if congestion is encountered.
When the sustained traffic through a packet-switching node exceeds the node’s capacity, the node must discard packets. Buffers only defer the congestion problem; they do not solve it. Consider the packet-switching network in Figure 13.13. Five stations attach to one of the network’s nodes. The node has a single link to the rest of the network with a normalized throughput capacity of \( C = 1.0 \). Senders 1 through 5 are sending at average sustained rates of \( r_i \) of 0.1, 0.2, 0.3, 0.4, and 0.5, respectively. Clearly the node is overloaded. To deal with the congestion, the node discards packets from sender \( i \) with a probability of \( p_i \).

a. Show the relationship among \( p_i \), \( r_i \), and \( C \) so that the rate of undiscarded packets does not exceed \( C \).

The node establishes a discard policy by assigning values to the \( p_i \) such that the relationship derived in part (a) of this problem is satisfied. For each of the following policies, verify that the relationship is satisfied and describe in words the policy from the point of view of the senders.

b. \( p_1 = 0.333; p_2 = 0.333; p_3 = 0.333; p_4 = 0.333; p_5 = 0.333 \)
c. \( p_1 = 0.091; p_2 = 0.182; p_3 = 0.273; p_4 = 0.364; p_5 = 0.455 \)
d. \( p_1 = 0.0; p_2 = 0.0; p_3 = 0.222; p_4 = 0.417; p_5 = 0.533 \)
e. \( p_1 = 0.0; p_2 = 0.0; p_3 = 0.0; p_4 = 0.0; p_5 = 1.0 \)
Part a: solution
We can support throughput of 1
But we have rates \( r \) total = 0.1 + 0.2 + 0.3 + 0.4 + 0.5 = 1.5
So we have to discard 1.5 - 1 = 0.5
How to distribute that 0.5?
\[ \sum r_i p_i = 0.5 \]
Meanings??

b. Same \( p_i \) for each sender. Each sender is penalized by the same percentage.
c. \( p_i \) is directly proportional to \( r_i \). The rate of penalty is proportional to the load generated.
d. This is known as a fair-share allocation. In this case the allowed flows are 0.1, 0.2, 0.2334, 0.2332, 0.2335. Thus, each source is given an equal share of the capacity.

\[ \text{ كيف اجت؟ } 0.2335 \]
\[ r_s p_s = 0.5 \times 0.533 = 0.2665 \] (مقدار النزول في ال rate)

new rate = 0.5 - 0.2665 = 0.2335

والباقي شرحو
e. Punish the highest-rate sender.