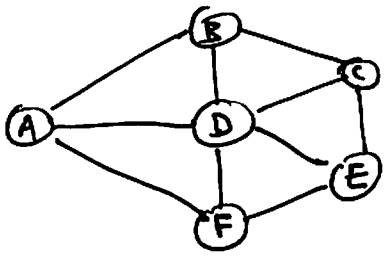
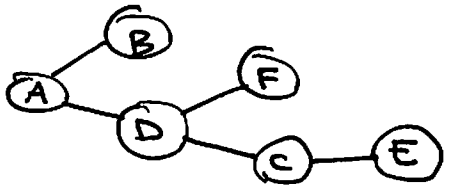
MORE ON ROUTING

6.02/Nov. 18, 2010

Ex. 1 (Lec. 18, problem 5, see also Nov. 16 notes)



Dijkstra @A →

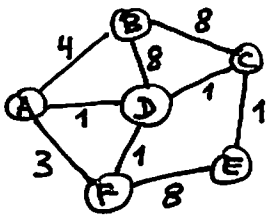


[a] WHICH OF A's LINKS CAN HAVE THE HIGHEST COST?

* NOT "AD", BECAUSE "ADF" IS OPTIMAL PATH, HENCE

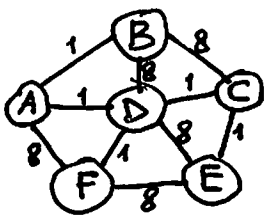
$$|AD| + |DF| \leq |AF| \implies |AD| < |AF|$$

* "AB" POSSIBLE:



CONSTRUCTING AN EXAMPLE: SET ARBITRARY WEIGHTS FOR THE OPTIMAL ROUTING TREE LINKS, OTHER LINKS SHOULD HAVE WEIGHTS ≥ DISTANCE ON THE "ORT"

* "AF" POSSIBLE:

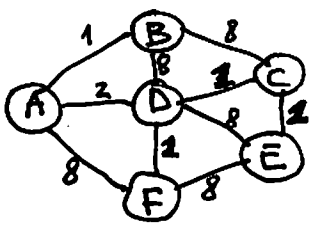


CONSTRUCTING AN EXAMPLE, SET ARBITRARY WEIGHTS FOR THE OPTIMAL ROUTING TREE, THEN SET "SUFFICIENTLY LARGE" WEIGHTS ELSEWHERE

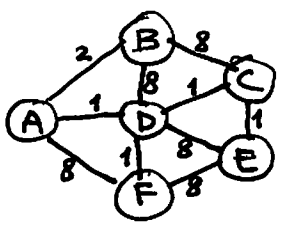
[b] WHICH A's LINKS CAN HAVE LOWEST COSTS?

* NOT "AF" (SEE (a))

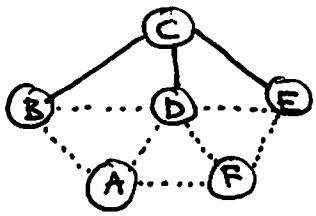
* "AB" POSSIBLE:



* "AD" POSSIBLE:



Ex.1 (CONTINUED)

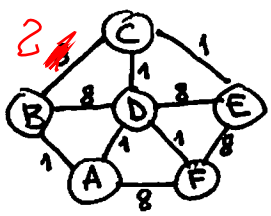


Dijkstra @C

PUTS "CB", "CD", "CE" ONTO THE OPTIMAL ROUTING TREE

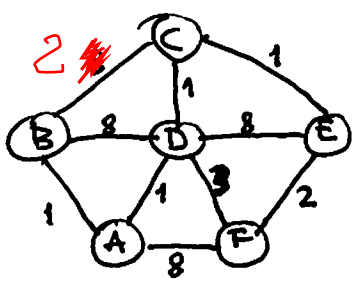
[c] WHICH OTHER LINKS ARE GUARANTEED TO BE ON THE OPTIMAL ROUTING TREE @C ?

* "AD" IS GUARANTEED:
  SINCE "ADC" IS THE ONLY OPTIMAL PATH A→C,
  "CDA" IS THE ONLY OPTIMAL PATH C→A
* SINCE "ORT" IS A TREE, CONTAINING "CB", "CD", "CE", "AD":
  "BD", "DE", "AB" ARE NOT ON IT
* EXAMPLE



SHOWS THAT "AF" AND "EF" ARE NOT NECESSARILY ON THE TREE

* EXAMPLE



SHOWS THAT "DF" IS NOT NECESSARILY ON THE TREE

[d] WHICH LINKS ARE GUARANTEED NOT TO BE ON THE "ORT @C"?

* "BD", "DE", "AB" BY THE "TREE" AND "OPTIMALITY" ARGS.
* NOT "DF" AND NOT "EF", BY THE EXAMPLES ABOVE
* "AF", BECAUSE "ADF" BEING OPTIMAL MEANS $|AD|+|DF| < |AF|$, HENCE $|AF| > |DF|$, HENCE $|DA|+|AF| > |DF|$

Ex.2 PACKET SIZE = 1KB

TRANSMISSION RATE = 100 KB/sec

PROPAGATION TIME = 10 ms (ROUNDTRIP)

ACK SIZE ≈ 0

MINIMAL RTT = ?

$$\text{TRANSMISSION TIME} = \frac{\text{PACK. SIZE}}{\text{TRANS. RATE}} = \frac{1}{100}\,\text{sec} = 10\,\text{ms}$$

MIN. RTT = TRANSM. TIME + PROP. TIME = 20 ms.

Ex.3 RTT SMOOTHING ALGORITH:

$$S_n = S_{n-1} + 0.1\,(r_n - S_{n-1})$$

r_n oscillates around 2ms "sinusoidally" with amplitude 2ms and period 4 samples

What will be the behavior of S_n?

$$H(e^{j\Omega}) = \frac{0.1}{1 - 0.9\,e^{-j\Omega}}$$

sinusoids w/ period = 4 : $\Omega = \frac{\pi}{2}$ $\left(= \frac{2\pi}{4}\right)$

$$\left|H(e^{j\frac{\pi}{2}})\right| = \left|\frac{0.1}{1 - 0.9\,j}\right| = \frac{0.1}{\sqrt{1.81}} \approx 0.074$$

$$\left|H(e^{j0})\right| = \left|\frac{0.1}{1 - 0.9 \cdot 1}\right| = 1$$

S_n will oscillate around 2ms with period 4 samples AND AMPLITUDE $\approx 0.074 \cdot 2 \approx 0.15$