midterm sample questions

Qiao Zhang

CSE 461 15sp Section 5

Problem: Multiple Choice Questions

1. This question tests your understanding of statistical multiplexing for resource sharing. Select ALL of the statements that are correct.
    - An example of a situation in which statistical multiplexing will work well is that of each user will call his/her friends on the user's birthday.
    - An example of a situation in which statistical multiplexing will work well is that users are calling their family when there is an earthquake.
    - The key benefit of statistical multiplexing is to guarantee that users can access the network even though there is sharing of capacity.
    - When users access the network independently, statistical multiplexing works well.

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Problem: Multiple Choice Questions

2. Select ALL statements that are TRUE regarding the classic Ethernet CSMA/CD protocol

- CSMA/CD eliminates collisions
- With each successive collision, stations randomize their retransmission over an interval that is twice as large
- Classic Ethernet uses BEB (Binary Exponential Backoff)
- Classic Ethernet is Aloha plus BEB

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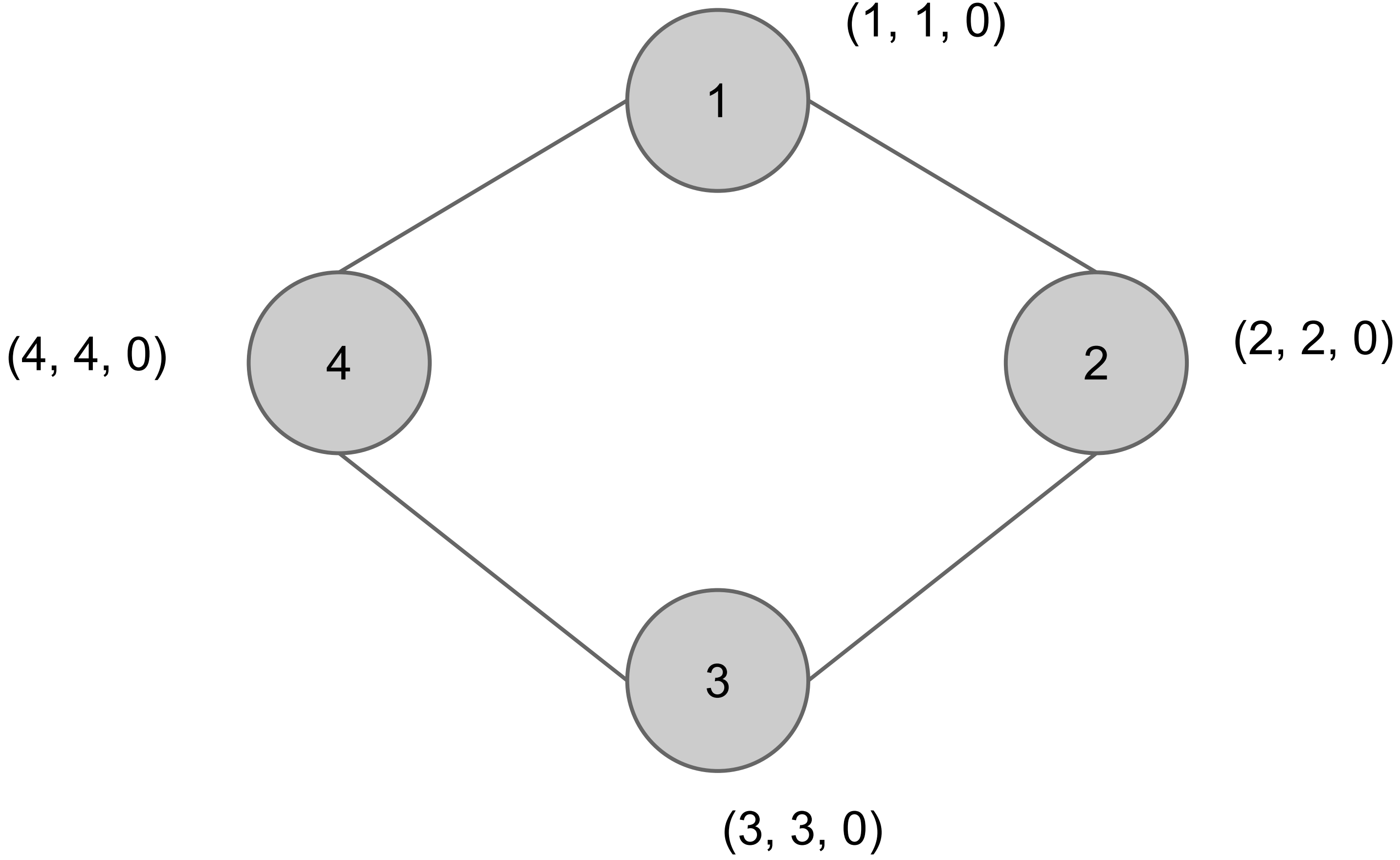
Problem: Multiple Choice Questions

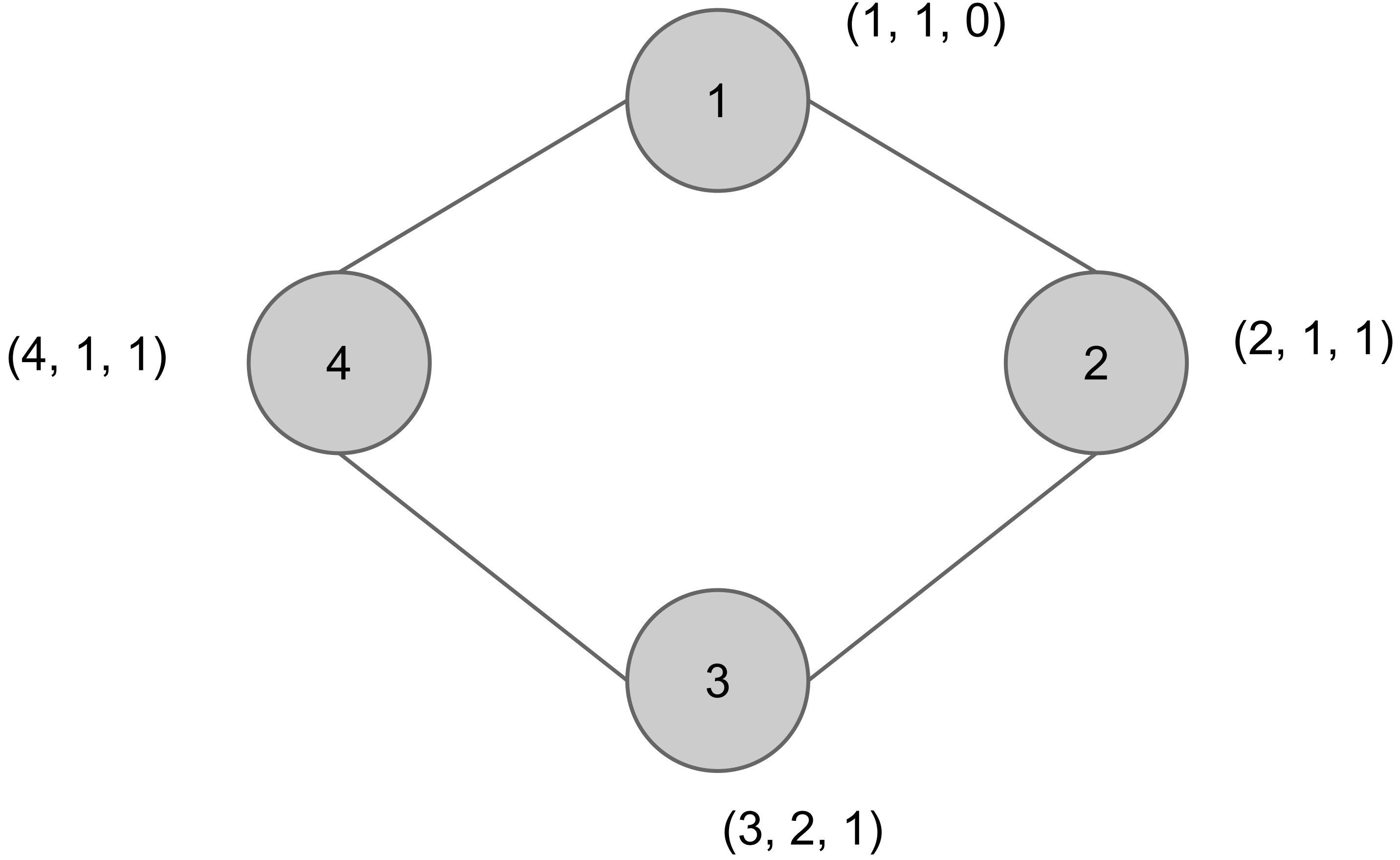
3. This question explores the spanning tree algorithm for switches. Consider four switches numbered 1, 2, 3, and 4 that are joined in that order in a circle (i.e., switch 4 is connected back to switch 1). *Check ALL statements that are TRUE concerning the spanning tree that is computed.* We suggest that you draw a figure and work out the spanning tree first yourself.

- The path from switch 3 to the root goes via switch 4.
- The link between switch 4 and switch 3 is turned off to break loops by the spanning tree algorithm.
- The root of the spanning tree is switch 1.
- The link between switch 2 and switch 3 is turned off to break loops by the spanning tree algorithm.

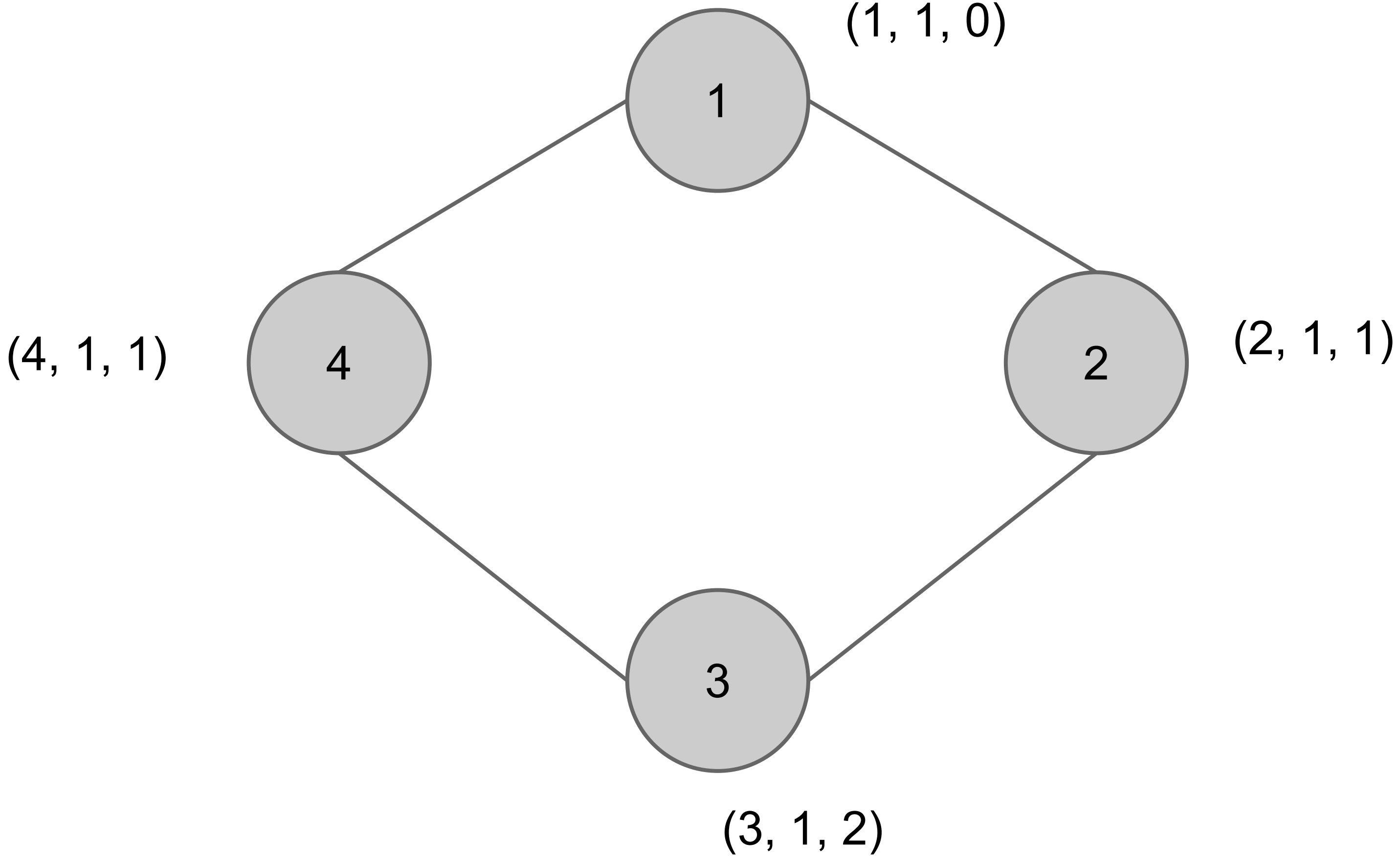
Round 1



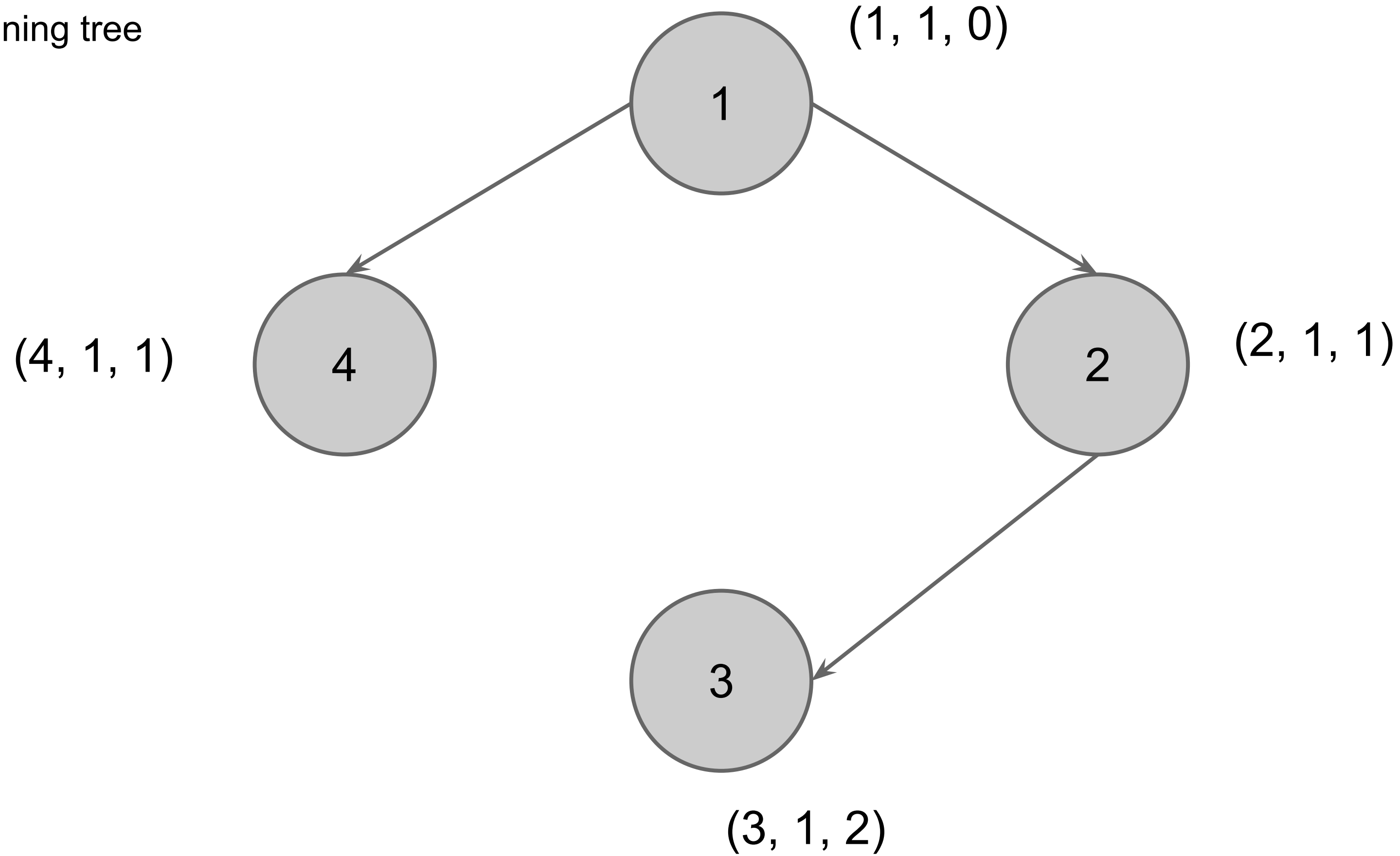
Round 2



Round 3



Final Round: has spanning tree



Problem: Multiple Choice Questions

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- **The link between switch 4 and switch 3 is turned off to break loops by the spanning tree algorithm.**
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Problem: Layering

1. This question asks you to think about how much of the network capacity is used for protocol headers compared to the message contents. A 800 byte message is sent over the network using a protocol stack with HTTP, SSL, TCP, IP, and WiFi. Each protocol header is 20 bytes long. What percentage of the network bandwidth "on the wire" is spent carrying protocol headers? Give a numeric answer only.

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20*5 = 100 bytes header

100/800 = 12.5%

Problem: Layering

2. This question tests your understanding of protocol layers and encapsulation. A protocol stack from top to bottom on a sending host uses the protocols SPDY, TCP, IPv6, and ADSL to send a message. What does the transmission unit look like in the network "on the wire"? Use the first letter of each protocol to represent its header, e.g., S for the SPDY header, plus the letter M to represent the message that is sent with this protocol stack. Type only the letters in the same order that the parts are sent "on the wire". (Sample answer "A B C M")

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AITS

Problem: Error Correction

The Hamming Code discussed in lecture 2-10 uses three check bits for four bits of data, with the check bits interleaved along with the data bits. (For example, when data=0101, the corresponding transmitted code is 0100101.) If the received Hamming code is 0011001, is there an error in the transmitted data? And if so, what is the correct data that the sender had transmitted?

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1,3,5,7: p1 = 0
2,3,6,7: p2 = 0
4,5,6,7: p3 = 0

no error detected

Problem: Transmission and Propagation Delays

(a) A 1500 byte packet is sent from your home to a server. It is first sent over a 6 Mbps cable link. Once it has been received completely, it is then sent over a 100 Mbps ISP link. The propagation delay of the cable link is 1 ms and the propagation delay of the ISP link is 10 ms. How long does it take for the packet to reach the server?

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d = 1500 * 8 bits / 6 Mbps + 0.001 s + 1500 * 8 bits / 100 Mbps + 0.01 s = 13.12ms

Problem: Transmission and Propagation Delays

(b) In the lectures we approximated the RTT (round-trip time) for a long link as 2D (twice the propagation delay), which ignores the transmission delay to send one message and to reply with a single-bit ACK. Here, we ask you to use a more accurate RTT that includes transmission delay. You should assume that no messages or ACKs are lost due to errors. You use a 1 Mbps link to send a series of 1250 byte messages across your city using the ARQ protocol. The propagation delay (D) of this link is 5 ms. What is the maximum rate at which data can be delivered over the link?

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one successful msg takes
1250 * 8 bits / 1 Mbps + 5 ms + 1 bit / 1 Mbps + 5 ms = 20.001 ms

effective max data rate = 1250 * 8 bits / 20.001 ms = 499.975 kbps

Problem: Fundamental Limits

Consider a transmission channel that is 12 MHz wide. How much data can be sent per second, if eight-level digital signals are used?

What signal to noise ratio is needed to get a bit rate of 4 Mbps (mega bits per second) on a channel with 1MHz bandwidth?

Problem: Fundamental Limits

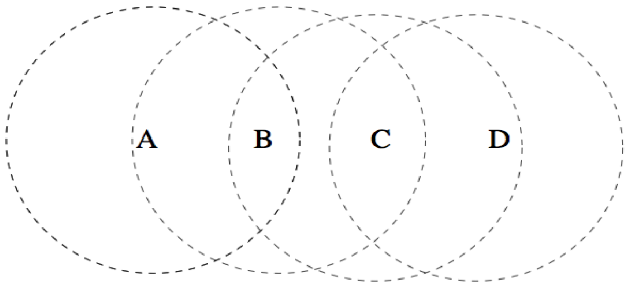
Consider a transmission channel that is 12 MHz wide. How much data can be sent per second, if eight-level digital signals are used?

Nyquist limit (noiseless channel)
2B log_2 V = 2 * 12 MHz * log_2(8) = 72 Mbps

What signal to noise ratio is needed to get a bit rate of 4 Mbps (mega bits per second) on a channel with 1MHz bandwidth?

Shannon limit
D = B log_2 (1 + S/N)
4 Mbps = 1 MHz * log_2 (1 + S/N)
S/N = 15

Problem: Wireless MAC Issues

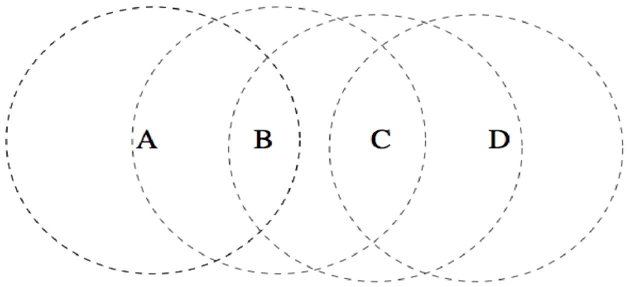


Consider the following topology of wireless laptops A, B, C and D. The dotted lines indicate the range of wireless transmissions from each node. For example, B is within range of A, A & C are within range of B, B & D are within range of C and only C is within range of D.

Assume that each node uses an RTS/CTS based MAC protocol

(a) If C sends B an RTS, why does A know not to transmit?
(b) If B is sending **data** to C, why does D know not to transmit?
(c) Using the nodes above, give an example of the hidden terminal problem.
(d) Macky Garulous is considering implementing a walkie-talkie service for his wireless PDAs.
His program largely uses small packets to avoid delaying any voice. Should Macky use RTS/CTS for his deployment? Why?

Problem: Wireless MAC Issues



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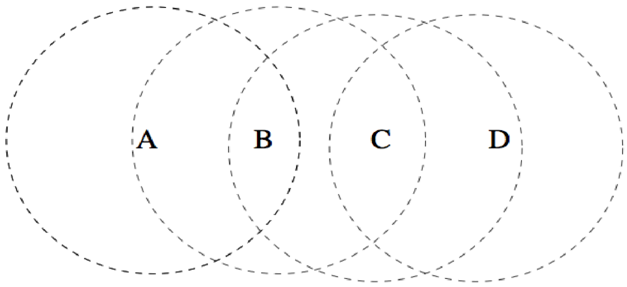
(a) If C sends B an RTS, why does A know not to transmit?

On receiving RTS from C, B replies with a CTS for C.

A would hear the CTS and know that B is talking with a hidden terminal C.

Problem: Wireless MAC Issues



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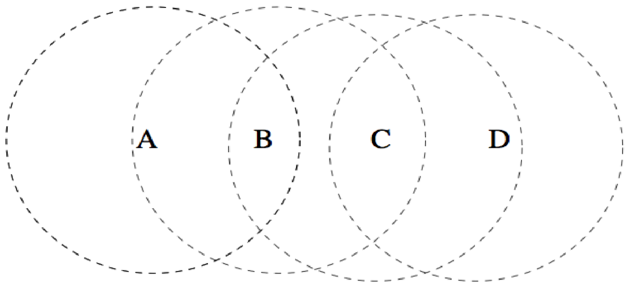
(b) If B is sending **data** to C, why does D know not to transmit?

In order for B to start sending data to C, B must have already gotten a "confirmation/promise" from C.

This CTS would have reached D.

Problem: Wireless MAC Issues



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(c) Using the nodes above, give an example of the hidden terminal problem.

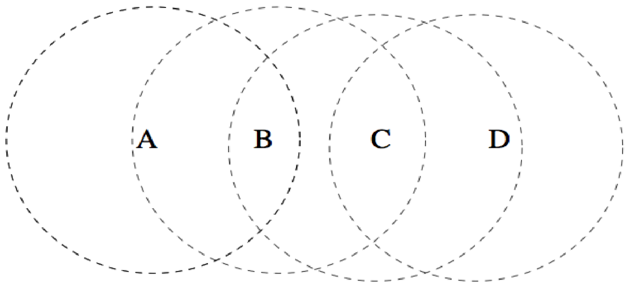
If A wants to send data to B, it's not enough that A just senses the channel for collision.

A might think no one is sending to B when in fact C is.

But since C is out of range for A, A wouldn't know that C is sending to B.

In this case, C is a hidden terminal. And because of this issue, CSMA/CD doesn't work for wireless.

Problem: Wireless MAC Issues



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(d) Macky Garulous is considering implementing a walkie-talkie service for his wireless PDAs.
His program largely uses small packets to avoid delaying any voice. Should Macky use RTS/CTS for his deployment? Why?
No. RTS and CTS for each packet causes large latency that can be unacceptable for chat application.