

Short Taps BY DENNIS E. SHASHA

Imagine you are a government official with confidential messages to send. But spies want to intercept the messages. To tap a certain microwave link, your opponents must be in the line of sight of the transmitter. This positioning puts them in danger of detection and arrest, so you are sure they will attempt the job only once and for no more than 10 minutes. The trouble is, you don't know which 10-minute intervals they will choose.

You have seven messages, labeled alphabetically, to send in as short a time as possible. Their lengths are:

- A : 2 minutes
- B : 3 minutes
- C : 4 minutes
- D : 5 minutes
- E : 6 minutes
- F : 7 minutes
- G : 8 minutes

Both easy

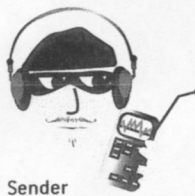
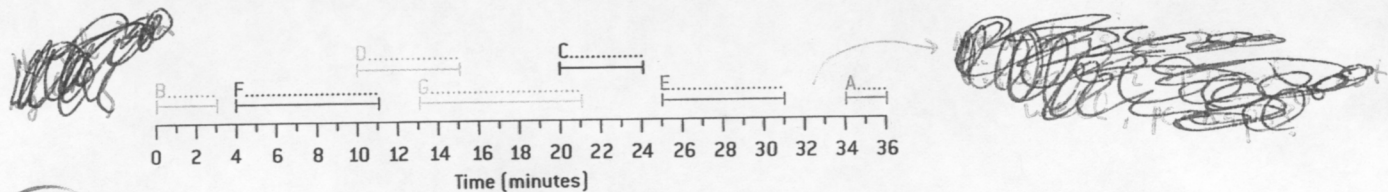
You will accept having the spies intercept up to three of these communiqués. You consider a message to be intercepted if it is tapped from start to

finish; a partly tapped message won't do them any good. You must send each message in one continuous transmission, but you can transmit as many as you like in parallel and can begin sending one or more messages while others are still being sent.

To warm up, suppose you can accept the enemy spies' tapping only one complete message. When should you send each message to minimize the total time? See the illustration below for a 36-minute solution.

Because you allow up to three messages to be tapped in the main problem, you may be able to reduce the time considerably. Can you find a way to send the seven messages in 15 minutes or less? If in addition to these seven messages, you had to send three four-minute messages without having more than three of the 10 tapped in their entirety, could you do it in 20 minutes or less?

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Sender



Spy

A WARM-UP SOLUTION

To send all the messages in 36 minutes with no more than one of them getting intercepted, transmit B at 0 minutes, followed by F at 4, D at 10, G at 13, C at 20,

E at 25, and A at 34. No 10-minute interval will contain two messages in their entirety. You may be able to discover a better solution.

Answer to Last Month's Puzzle

At least one and at most three containers of goods travel from country A to country D. Country E receives at most two containers from A and possibly none. In the second problem, D gets at most three containers from A but possibly none. The minimum and maximum numbers from A arriving at E do not change.

Web Solution

For a fuller explanation of last month's solution and a look at the answer to this month's problem, visit www.sciam.com

...to you.