THE COFFEE PROBLEM

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Alice and Bob sit down to have coffee at a cafe. They are each served 6 oz of coffee at a temperature of 210° F.

The room temperature in the cafe is 76° F. There is cream on the table, which is kept on ice at a constant temperature of 40° F.

The scientifically inclined staff has noted that a cup of coffee (with or without cream) will cool to 80° F in 30 minutes.

Alice immediately adds 1 oz of cream to her coffee, but doesn't start drinking it. The two talk for 10 minutes without drinking. At the end of 10 minutes, Bob adds 1 oz of cream to his coffee and the two start drinking.

(1) What are the temperatures of Alice's and Bob's coffee when they start drinking it? Who has the hottest coffee?
(2) Does the answer to the question "Who has the hottest coffee?" depend on the numbers given above?

To figure out the temperature after adding the cream, we use the following approach. If you add 1 oz of cream at temperature T_{cream} to 6 oz of coffee at temperature T_{coffee} you get 7 oz of a mixture at temperature

$$\frac{1}{7}\,T_{\text{cream}} + \frac{6}{7}\,T_{\text{coffee}}.$$

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