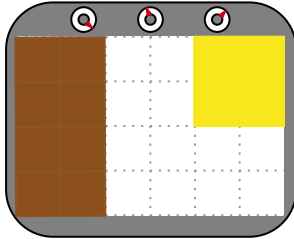


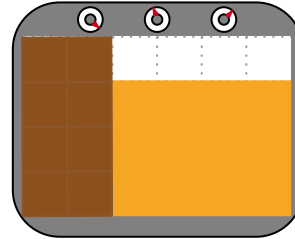
The Baker's Conundrum

A Hands-On Game about Optimization

Every year, families gather together for large feasts during the holidays. This means preparing and baking several different items, such as poultry, fish, bread, cakes, cookies, etc. With a single oven available in the kitchen and each item requiring a certain amount of space and time in the oven, choosing the order in which to bake these items (and arranging them in the oven) can make a difference in terms of total baking time. (The sooner we are done, the sooner we can eat, right? Yum!) Consider an example. We are baking 3 items at 350°F: a turkey (orange 3 × 4 dish, for 3h), muffins (yellow 2 × 2 tray for 1h), and a meatloaf (brown 2 × 4 dish, for 2h). If our oven size is 4 × 6, here is one way to bake them:

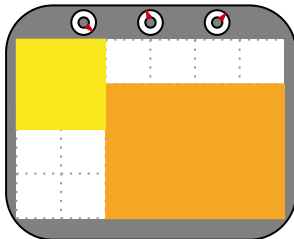


Step 1: Bake meatloaf and muffins together for 1 hour, then remove muffins.

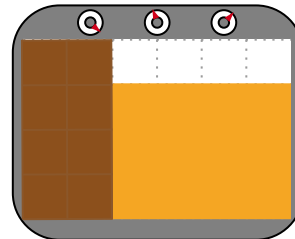


Step 2: Add turkey. Bake for 1h, remove meatloaf, keep turkey for another 2h. Total time = 4h.

And here is another way to bake them:



Step 1: Bake muffins and turkey together for 1 hour, then remove muffins.



Step 2: Add meatloaf and bake together with turkey for another 2h. Total time = 3h.

Note that the second baking strategy saves 1 hour of baking time. Do you think it is possible to bake these 3 items in less than 3h? If so, how? If not, why not?

The next page has several items ready to be baked at 350°F in a 7 × 5 oven. Cut out the pieces with a pair of scissors to move them in and out of the oven. The time it takes to bake each item is written inside the item itself. How would you sequence their baking to finish preparing your feast as soon as possible? When you are done playing with those items, come up with your own items to continue playing.

Additional Questions for Discussion:

How do you know for sure that your solution is the best possible?

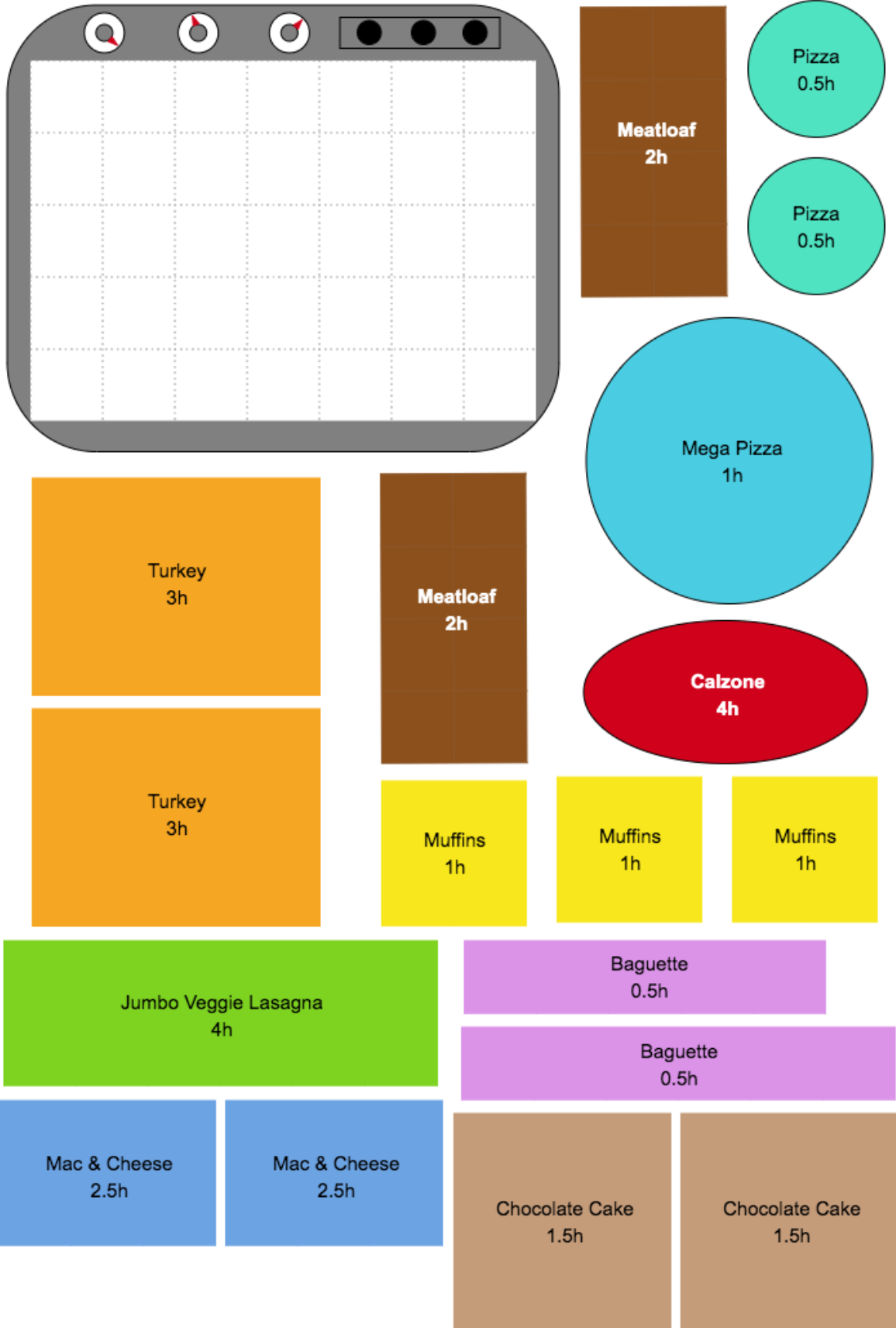
What assumptions or simplifications from a real-life situation were made while solving this problem?

Variations of the game: (a) We assumed all items were ready to start baking at the same time, but what if some of them are still being prepared? (b) It could be that some items have precedence over others (they need to be ready first). How would that affect the solution? (c) What if items bake at different temperatures? (d) What about an oven with multiple shelves?

(This game was created by [Prof. Tallys Yunes](#) from the University of Miami. It is licensed under a [Creative Commons Attribution-NonCommercial 3.0 Unported License](#).)

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