

## General description

Welcome to the town of *Quendhur*, a town steeped in magic and inhabited by highly skilled craftspeople adept in crafting swords, armor, and all necessities fit for a knight embarking on a quest.

As the fate of the town hangs in the balance of your quest, you must equip yourself with three essential items: a sword, helmet, and shield to brave the unknown perils that lie ahead.

Each item requires a set of tasks to be performed in a specific sequence in order to be ready for use. The sword needs 3 days so that the iron can be properly forged (task 1), then 2 days so that the sword can be properly shaped and cooled (task 2), and another 2 days so that it can be customized and decorated (task 3). The helmet needs 3 days for the bronze to be forged (task 1), 4 days to be shaped and cooled down (task 2), and 1 day for the final decorations (task 3). Finally, the stone for the shield needs no forging time, 4 days to be properly shaped (task 2) and 3 days to be decorated (task 3).

Forging of a metal (tasks of type 1) can only be carried out by the single ironsmith in town. Shaping and cooling of an item (tasks of type 2) can only be carried by the single carpenter in town. The final decorations of an item (tasks of type 3) can only be carried out by the single ceramist in town.

Delaying the start of the quest might have disastrous consequences for the town, but leaving early for the quest without the proper gears might be as disastrous. **Hence, the goal of the knight is to decide how to allocate the aforementioned tasks to the three craftspeople so that the sword, helmet, and shield are all completed in the smallest amount of days.**

## Game Setup

Figure 1 defines the 8 tasks needed to complete the sword (3 tasks), the helmet (3 tasks), and the shield (2 tasks). Each task is characterized by a unique combination of a logo representing the item, the number of the task (1, 2, or 3), and a color. The left-most column is not strictly needed as the first row contains sword-specific tasks (in different shades of orange), the second helmet-specific tasks (in different shades of green), and the third shield-specific tasks (in different shades of blue), but it is added for clarity.

sword	⚔ Task 1	⚔ Task 1	⚔ Task 1	⚔ Task 2	⚔ Task 2	⚔ Task 3	⚔ Task 3
helmet	🛡 Task 1	🛡 Task 1	🛡 Task 1	🛡 Task 2	🛡 Task 3	🛡 Task 3	🛡 Task 3
shield	🛡 Task 2	🛡 Task 2	🛡 Task 2	🛡 Task 2	🛡 Task 3	🛡 Task 3	🛡 Task 3

Figure 1: Set of 8 tasks (3 for the sword and the helmet, 2 for the shield) to be completed in order for the quest to start.

Your first step is to cut the 8 tasks in order to have 8 rectangles to place in the calendar to visualize your solution. Make sure you do not subdivide tasks. Figure 2 depicts the calendar where each row represents the schedule of a craftspeople (ironsmith, carpenter, and ceramist): **your goal is to place the 8 tasks obtained from Figure 1 on the calendar so that tasks do not overlap, tasks are assigned to the designated craftspeople, and tasks follow the designated sequence (i.e., a task 2 of a specific item must start when task 1 of the same item is finished, and a task 3 of an item must start when task 2 of the same item is finished).**

Whether you are playing solo, in a cooperative group, or competing against each other, implementing a time limit (e.g., 5 minutes) can accelerate the process and add pressure to the decision-making dynamic.

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12
Ironsmith												
Carpenter												
Ceramist												

Figure 2: Calendar where to place to 8 tasks and visualize the solution.

## Game Rules and Instructions

We re-state now the rules that we already presented before, but in a more formal way:

- all “task 1” tasks can only be completed by the ironsmith
- all “task 2” tasks can only be completed by the carpenter
- all “task 3” tasks can only be completed by the ceramist
- a task, once started, must run to completion (i.e., tasks cannot be divided into sub-tasks)
- a craftsperson can work on only one task at a time (i.e., tasks cannot overlap)
- for each item, no task “task  $n + 1$ ” can start unless “task  $n$ ” is finished (i.e., the three items must be built following the correct sequence of tasks)

**The calendar of Figure 2 spans 12 days. This suggests that a feasible solution can be found where all 3 items (sword, helmet, and shield) are ready in 12 days. But maybe Quendhur cannot wait 12 days, and neither can you! Try to find the optimal solution that minimizes the number of days you must wait.**

You can check such a solution in the repository [here](#).