

# 1 Civilizations and Technologies

My little brother really enjoys playing Age Of Empires 2.

(Honestly, it's the best RTS game of the last 30 years, enjoy it before Chlorophyllai takes control)

My little brother drew this small table that presents certain civilizations (rows) and certain technologies (columns) available in the game. A triangle is present in cell  $(i, j)$  if and only if the civilization in row  $i$  DOES NOT HAVE ACCESS to the technology in column  $j$ .

	Bloodlines	Bombard_Cannon	Heated_Shot	Blast_Furnace	Gold_Shaft_Mining	Crop_Rotation
Ethiopians	▼	▼				▼
Japanese		▼				▼
Sicilians	▼				▼	
Slavs	▼		▼			▼
Spanish		▼				

In reality, this is unfortunately no longer true because my brother completely mixed up the order of civilizations and technologies.

Can you put the civilizations and technologies back in their place so that they match the triangles?

Flag

The file 'flag-steps-fake.txt' serves as an example to guide you on how to create the FLAG. Except for one big detail, reproduce exactly the steps in 'flag-steps-fake.txt'.

The big detail is, of course, that you must arrange all civilizations in the correct order, followed by all technologies in the correct order, before proceeding with the steps.

2 Civilizations and Technologies, Take 2

My brother made the same mistake with this drawing too, but this time the table is larger. Good luck sorting through the  $9! \times 11!$  possible arrangements.

	Bracer	Ring_Archer_Armor	Treadmill_Crane	Redemption	Sanctity	Heavy_Demolition_Ship	Dry_Dock	Bloodlines	Husbandry	Thumb_Ring	Heavy_Cavalry_Archer
Armenians											
Aztecs											
Byzantines											
Cumans											
Franks											
Georgians											
Gurjaras											
Koreans											
Saracens											

Flag

Same protocol as previous challenge

## Other Comments

- The AOE2 data used comes from the most recent version at the time of writing this (DE version in effect in February 2024).
- The color alternation is just for better visibility, it doesn't signify anything.

## Solution guide

A detailed solution guide will not be provided for this hero puzzle. In essence, for each table, there are two steps:

- Search the internet (or rely on your knowledge if you are experienced players) for the necessary data on the civilizations and technologies involved.
- Find the permutations of civilizations and technologies that make the table accurate.

For the first step, the most efficient way to proceed is by visiting the pages:

[https://ageofempires.fandom.com/wiki/\[any technology\]](https://ageofempires.fandom.com/wiki/[any technology])

where you replace [any technology] with the technology you need. You can manually extract what you need or write a script. No script for this step is provided in the solution guide (even though a script was indeed used to create the puzzle).

For the second step, you can search for the correct permutations manually or code an algorithm that does it for you. In the Java code provided with the solution guide, a custom algorithm is implemented, but it is not necessary for the participant, as it is faster to proceed manually than to code it. (In fact, the code is more for the puzzle creator who must ensure that the grid pattern is non-trivial while having a single solution.)

In essence, here are the corrected grids:

<b>Heated_Shot</b>	▼	▼			
<b>Bloodlines</b>			▼		
<b>Blast_Furnace</b>					
<b>Gold_Shift_Mining</b>				▼	
<b>Bombard_Cannon</b>	▼	▼			▼
<b>Crop_Rotation</b>	▼		▼	▼	
	<b>Japanese</b>				
	<b>Slavs</b>				
	<b>Ethiopians</b>		▼		
	<b>Spanish</b>				▼
	<b>Sicilians</b>				

	Ring_Archer_Armor								
	Bloodlines								
	Redemption	▼							
	Sanctity								
	Heavy_Demolition_Ship	▼			▼				
	Dry_Dock	▼							
	Husbandry	▼							
	Bracer	▼							
	Thumb_Ring		▼						
	Heavy_Cavalry_Archer		▼						
	Treadmill_Crane	▼							
Cumans									▼
Armenians	▼								
Aztecs			▼					▼	
Koreans							▼		
Saracens									
Georgians				▼			▼		▼
Gurjaras		▼					▼		▼
Byzantines								▼	
Franks	▼			▼	▼			▼	▼

## Flags

FLAG{4e0d18448c7a6cd1aa8c6af049fb897fb73f6fe8}  
 FLAG{b9e43ad8a2832f47ffc793c94f46dba2478bab8d}

## Code link

<https://github.com/desharnc27/incoming-csg-2024-java>