

Exam NMCGJ

24/02/2016



The questions can be answered in English and/or Italian.

1. Discuss multidimensional arrays in Java. Moreover, explain what are the differences and pros/cons with respect to the Java container classes.
2. What is inheritance in Java? Discuss its use and advantages. Explain also its relation with abstract classes and interfaces.
3. Discuss extensively the classical ray-tracing algorithm.
4. What is the canonical view volume (perspective transform)? Discuss its purpose and advantages.
5. We would like to make a simple cartoon animation involving the following truck:



- More precisely, we want that this truck drives (horizontally) from a given point A to a given point B . To give the impression of a driving vehicle, we would like that (1) the above picture of the truck moves from A to B and that (2) the two visible wheels of the truck are rotating in the meantime. The rotation speed of the wheels can be freely chosen. The whole animation should take T seconds.
 - Work out in detail how to make this animation, describing all the transformation matrices that you need to use for (each part of) the truck.
 - Describe also how you would like to represent (each part of) the truck.
6. In the course we have seen a fast algorithm (Kadane's algorithm) to solve the maximum subarray sum problem, i.e., to find the contiguous subarray within a given array which has the largest sum. Its complexity is $O(n)$ with n the length of the given array.
 - Work out a slightly different variation of the algorithm that not only produces as output the sum of the subarray but also the start index and end index of the subarray with the largest sum.
 - Write the alternative algorithm in Java using only a single *while* loop (no *for* loops).
 - Determine the *while* invariants and prove the correctness of your algorithm (give the full detailed proof).