

Erlangen, 23. January 2017

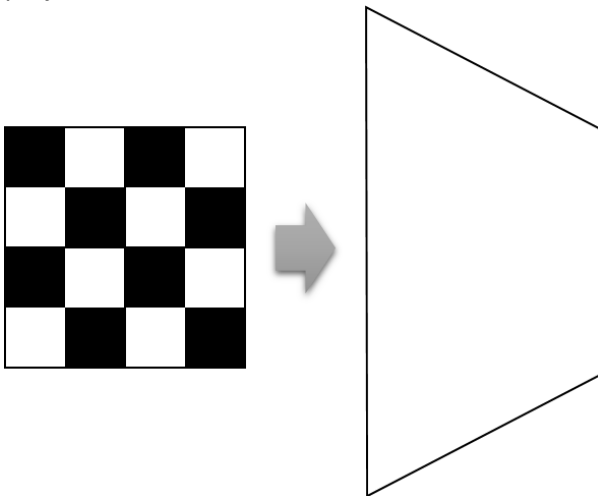
**Computer Graphics** (Exercise Sheet 12 [Bonus])

**Submission (Mailbox LS9):** Monday, 30. January 2017, 23:59 pm

**General Information:** The exercise sheets covers old exam assignments. You have to hand in your solution using the LS9 mailbox. Make sure that you **write your names on every sheet** you hand in!

**Assignment 1** [5 Points] (Textures)

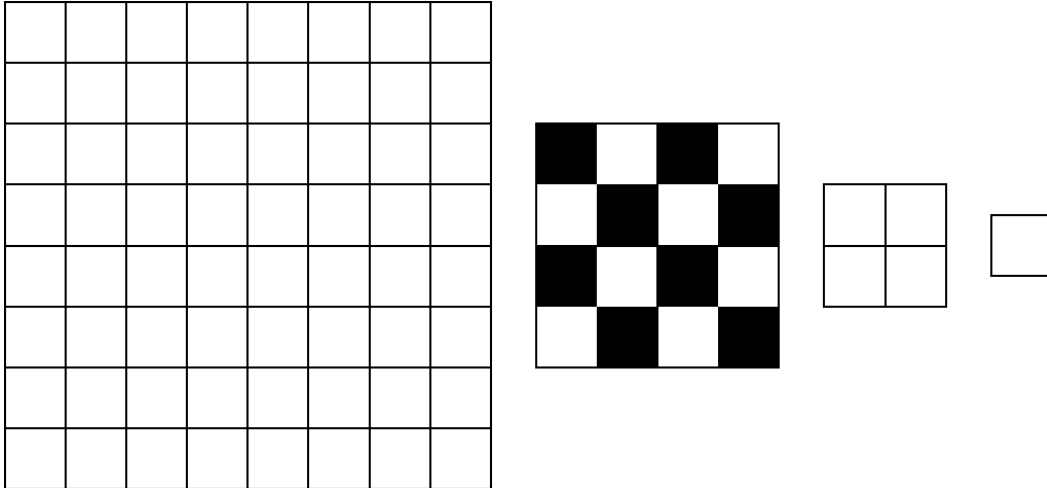
- a) Map the checker board texture to the neighboring perspective square using correct perspective projection.



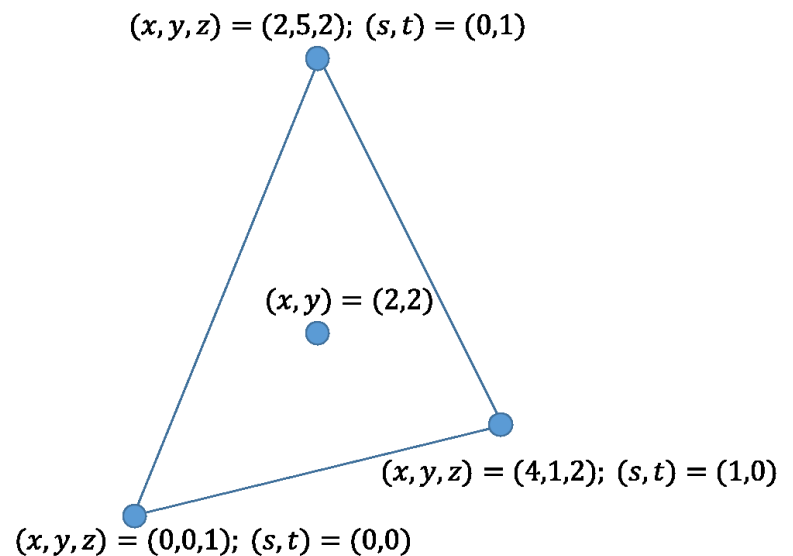
- b) Why is the above mapping not affine?
- c) State (shortly!) the three dimensions, in which tri-linear MIP-mapping happens.

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- d) The 4x4-texture from sub-assignment a) is part of a MIP-map-pyramid. Fill in the missing levels of the pyramid. For MIP-map filtering you can assume a simple box filter.



- e) Given is the triangle on the right with 2D-vertices  $(0,0)$ ,  $(2,5)$ , and  $(4,1)$ . With the vertices, also their z-coordinate as well as texture coordinates  $(s,t)$  are provided. Compute a perspective-corrected interpolation of the texture coordinates at position  $(2,2)$  (2D-barycenter of the triangle).



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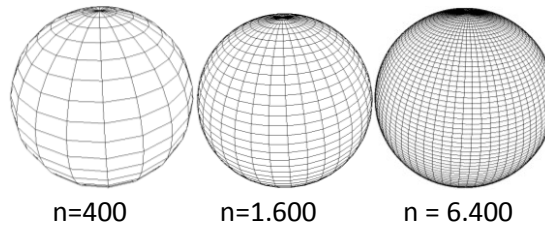
**Assignment 2** [4 Points] (Ray Casting)

- a) Intersect the sphere with center  $(1,2,6)$  and radius 5 with the ray  $(4,6,0) + t(0,0,1)$ . How many intersection points are there? State the intersection point(s).

- b) Intersect the same sphere as in a) with the ray  $(1,6,0) + t(0,0,1)$ . How many intersection points are there? State the intersection point(s).

- c) Explain (ideally with a formula) how you can generally find the intersection of a ray  $e + td$  with a triangle with vertices A,B,C. It is sufficient to provide a system of equations!

- d) Given is a sphere, subdivided into  $n$  quadrilaterals and to be rendered into an image full frame. State the time complexity (in O-notation) of ray-casting, depending on the number  $p$  of pixels and the number  $n$  of quadrilaterals.



$O( \quad )$

- e) How does time complexity change if you directly intersect the rays with the sphere (as in sub-assignment a) instead of the quadrilaterals?

$O( \quad )$