

Lab 13

3D Computer Graphics

Introduction

No new jar file is provided for this Lab. The idea is that you keep on working on your version of the rendering framework which you obtained after finishing the exercises of Lab 12. However, it is strongly advised that you make a new fresh copy of the project of Lab 12 and rename this copy to 3DCG_Lab13. This will make it easier for you to look again at the work you did in each Lab when you study for the exam later on.

The aim of this Lab is to check your final rendering framework.

Exercise 1

- a) Study the scene description below. Can you imagine how the scene looks like?

```
background 0 0 0
light 0 14 0 0.9 0.9 0.9
ambient 0.08 0 0.05
diffuse 0.1 0.1 0.1
reflectivity 0.7
push translate 0 0 -15 scale 15 15 1 square pop
diffuse 1 0 0
reflectivity 0
push rotate -90 0 1 0 translate 0 0 -15 scale 15 15 1 square pop
diffuse 0 0 1
push rotate 90 0 1 0 translate 0 0 -15 scale 15 15 1 square pop
ambient 0.45 0.45 0.45
diffuse 1 1 1
push rotate 90 1 0 0 translate 0 0 -15 scale 15 15 1 square pop
push rotate -90 1 0 0 scale 15 15 1 square pop
ambient 0.08 0 0.05
diffuse 0.1 0.1 0.1
reflectivity 0.7
push rotate 180 1 0 0 translate 0 0 -15 scale 15 15 1 square pop
ambient 0.24725 0.1995 0.0745
diffuse 0.75164 0.60648 0.22648
reflectivity 0.08
push translate 3 2 0 scale 2 2 2 sphere pop
```

- b) Create a new file `sceneA.sdl` in the `resources` folder and put the commands listed above in this file.

- c) Create a new package `apps.app9`.
- d) Create a new graphical application (**App9**) in this package.
- e) Configure this graphical application as follows:
 - The scene to be rendered is described in the `sceneA.sdl` file.
 - The width and height of the canvas are 600 and 450 pixels, respectively.
 - The eye of the camera is located at $(-6, 5, 14)$.
 - The camera is aimed at $(-2, 5, 0)$.
 - The upwards vector of the camera is in the direction of the y -axis.
 - The worldwindow has a width and height of $4/3$ and 1, respectively, and is located 0.95 units in front of the camera.
 - The scene has to be rendered with shadows, without reflections and supersampling turned off.
- f) Run **App9** and verify your answer to a).
- g) Explain why one of the walls is almost entirely black.
- h) How will the image change if you turn reflections on with a maximum recursion depth equal to 1?
- i) Run **App9** and verify your answer.
- j) How will the image change if you increase the maximum recursion depth to 2?
- k) Run **App9** and verify your answer.
- l) Run **App9** with a maximum recursion depth set to 15. (You should obtain the image shown on the last page of this pdf file.)

Exercise 2

- a) Create a new package `apps.app10`.
- b) Create a new graphical application (**App10**) in this package.
- c) Configure this graphical application as follows:
 - The scene to be rendered is described in the `sceneB.sdl` file.
 - The width and height of the canvas are 600 and 450 pixels, respectively.

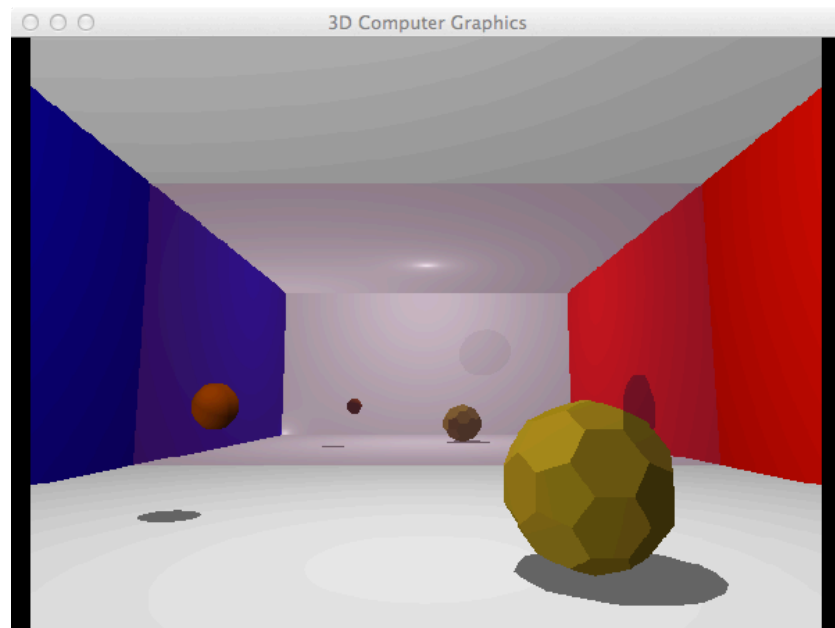
- The eye of the camera is located at (0, 5, 24).
- The camera is aimed at (0, 8, 0).
- The upwards vector of the camera is in the direction of the y -axis.
- The worldwindow has a width and height of $4/3$ and 1, respectively, and is located 0.95 units in front of the camera.
- The scene has to be rendered with reflections, a maximum recursion depth set to 1 and supersampling turned off.

d) Create a new file **sceneB.sdl** in the **resources** folder.

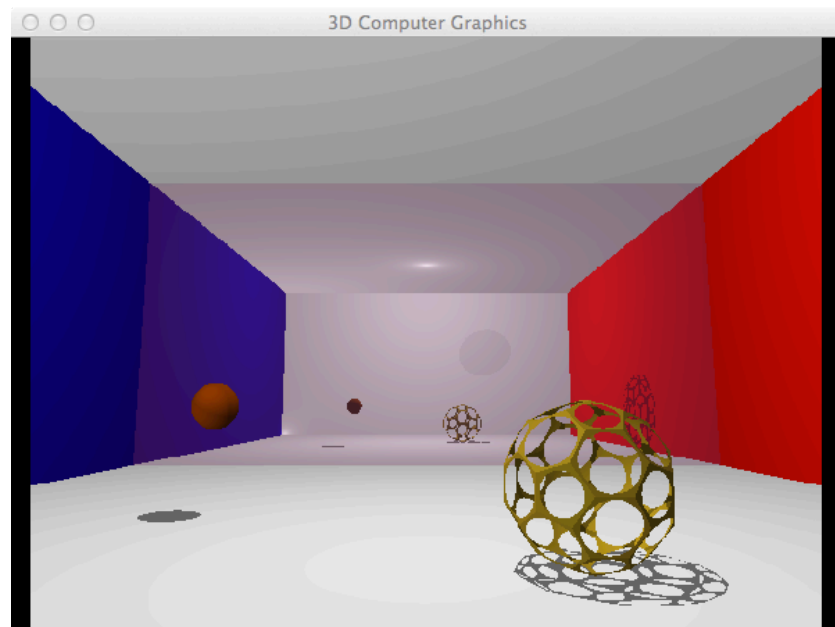
e) This file should contain the following commands

```
background 0 0 0
light -24.5 0.1 24.5 0.4 0.4 0.4
light 0 24 5 0.5 0.5 0.5
ambient 0.08 0 0.05
diffuse 0.1 0.1 0.1
reflectivity 0.7
push translate 0 0 -25 scale 25 25 1 square pop
diffuse 1 0 0
reflectivity 0
push rotate -90 0 1 0 translate 0 0 -25 scale 25 25 1 square pop
diffuse 0 0 1
push rotate 90 0 1 0 translate 0 0 -25 scale 25 25 1 square pop
ambient 0.45 0.45 0.45
diffuse 1 1 1
push rotate 90 1 0 0 translate 0 0 -25 scale 25 25 1 square pop
push rotate 180 1 0 0 translate 0 0 -25 scale 25 25 1 square pop
push rotate -90 1 0 0 scale 25 25 1 square pop
ambient 0.24725 0.1995 0.0745
diffuse 0.75164 0.60648 0.22648
reflectivity 0.08
push translate 5 2.6 6 scale 2.6 2.6 2.6
mesh resources/buckyball.txt
pop
ambient 0.19125 0.0735 0.0225
diffuse 0.7038 0.27048 0.0828
reflectivity 0
push translate -9.3 5 -1 scale 1 1 1 sphere pop
```

f) Run **App10** and verify that you get the image shown below



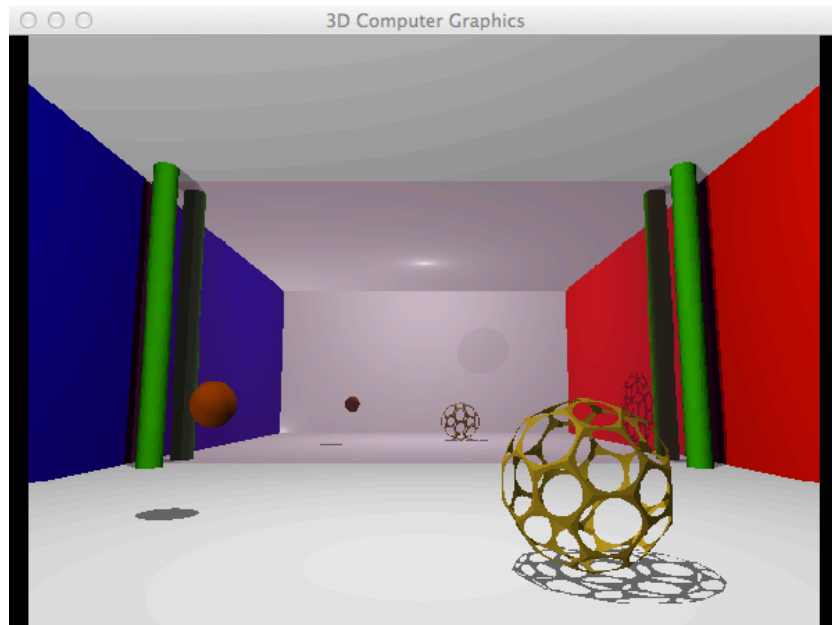
- g) You should see several shadows in your image. Can you explain each of them?
- h) Change the `sceneB.sdl` so that you get the following image on your screen



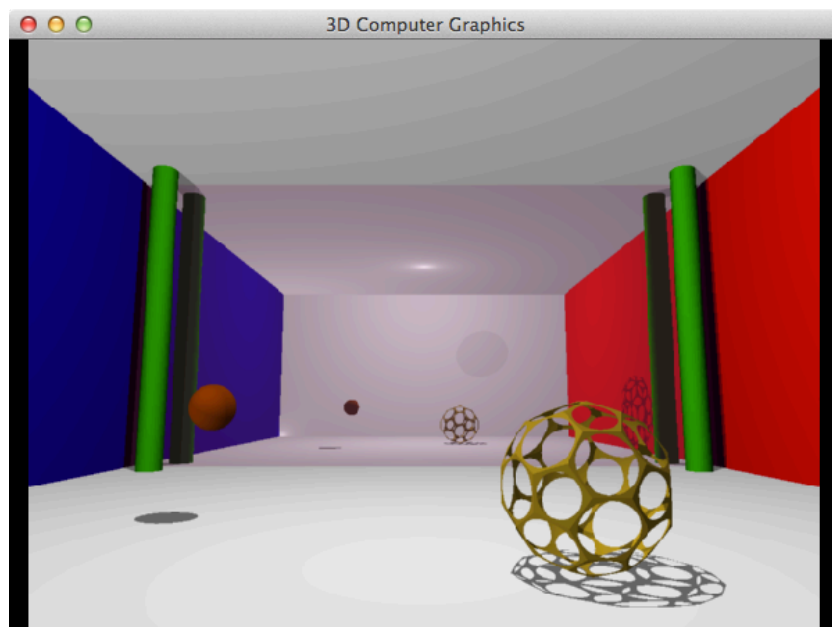
Note that this new image can be used to verify your answer to g).

- i) Change the `sceneB.sdl` so that you create 2 pillars supporting the

ceiling as shown in the image below.



- j) The last image suffers a lot from jaggies. Make the necessary change to get a nicer image as shown below.



- k) Make the necessary changes to your rendering framework which allow to add a small orange cube to the scene. It should be positioned in the middle of the floor.

Exercise 1 - part II

