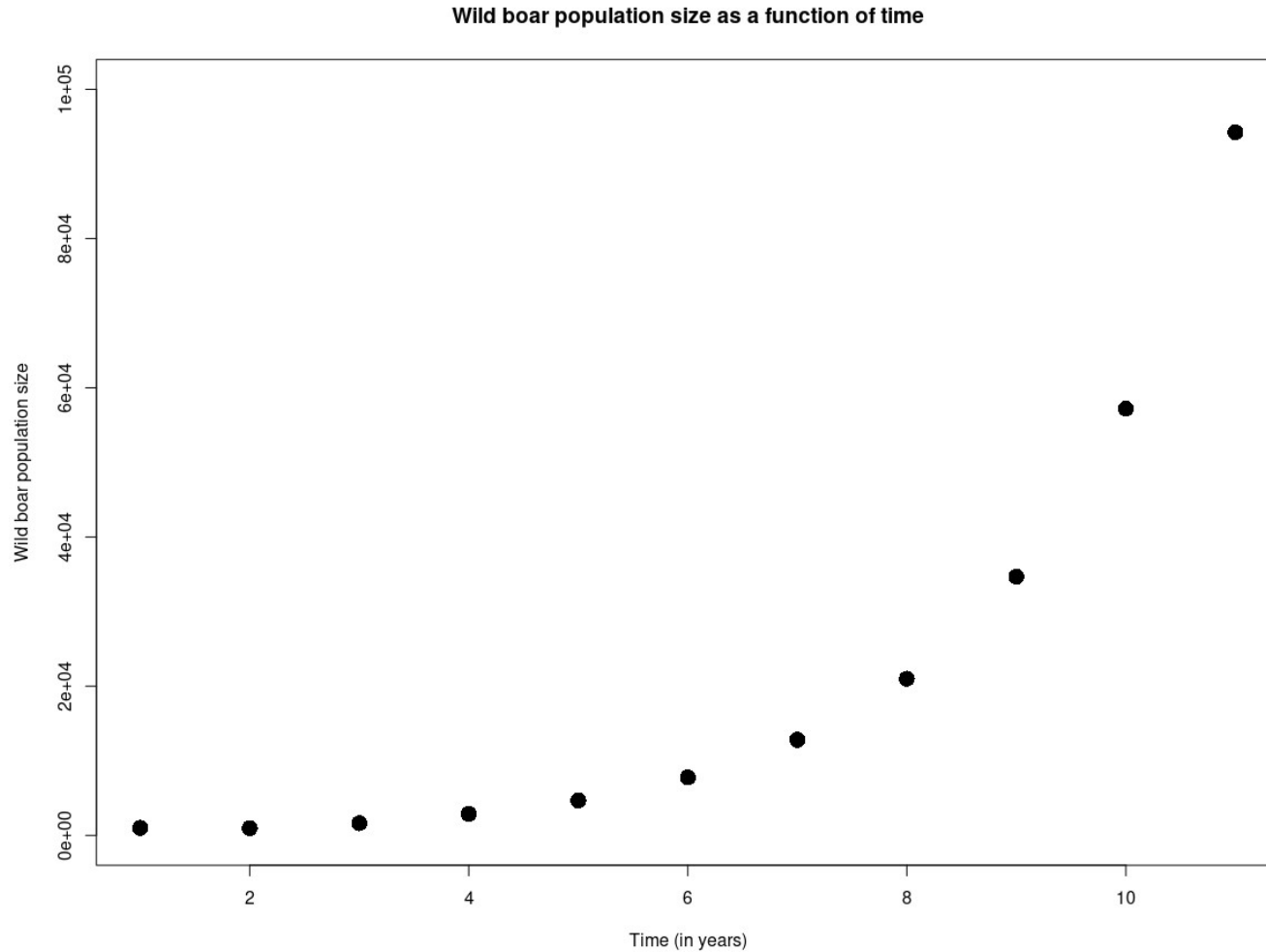


Answers for Exercise sheet 1: Leslie matrices

1.a. Constructing the Leslie matrix

$$\begin{bmatrix} 0.456 & 1.68 & 3.40 & 3.40 & 3.40 & 3.40 \\ 0.52 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.60 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.71 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.71 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0.71 & 0 \end{bmatrix}$$

1.b. Iterating the matrix



1.c. Eigen analysis

Population growth rate:

```
lambda = eigen(L)$values[1] = 1.648
```

Stable age distribution:

```
age_distr = eigen(L)$vectors[,1]/sum( eigen(L)$vectors[,1] )  
          = c(0.662, 0.209, 0.076, 0.033, 0.014, 0.006)
```

1.d. Compute R_0

Vector of effective fecundities:

$$f = L[1,] = c(0.456, 1.680, 3.400, 3.400, 3.400, 3.400)$$

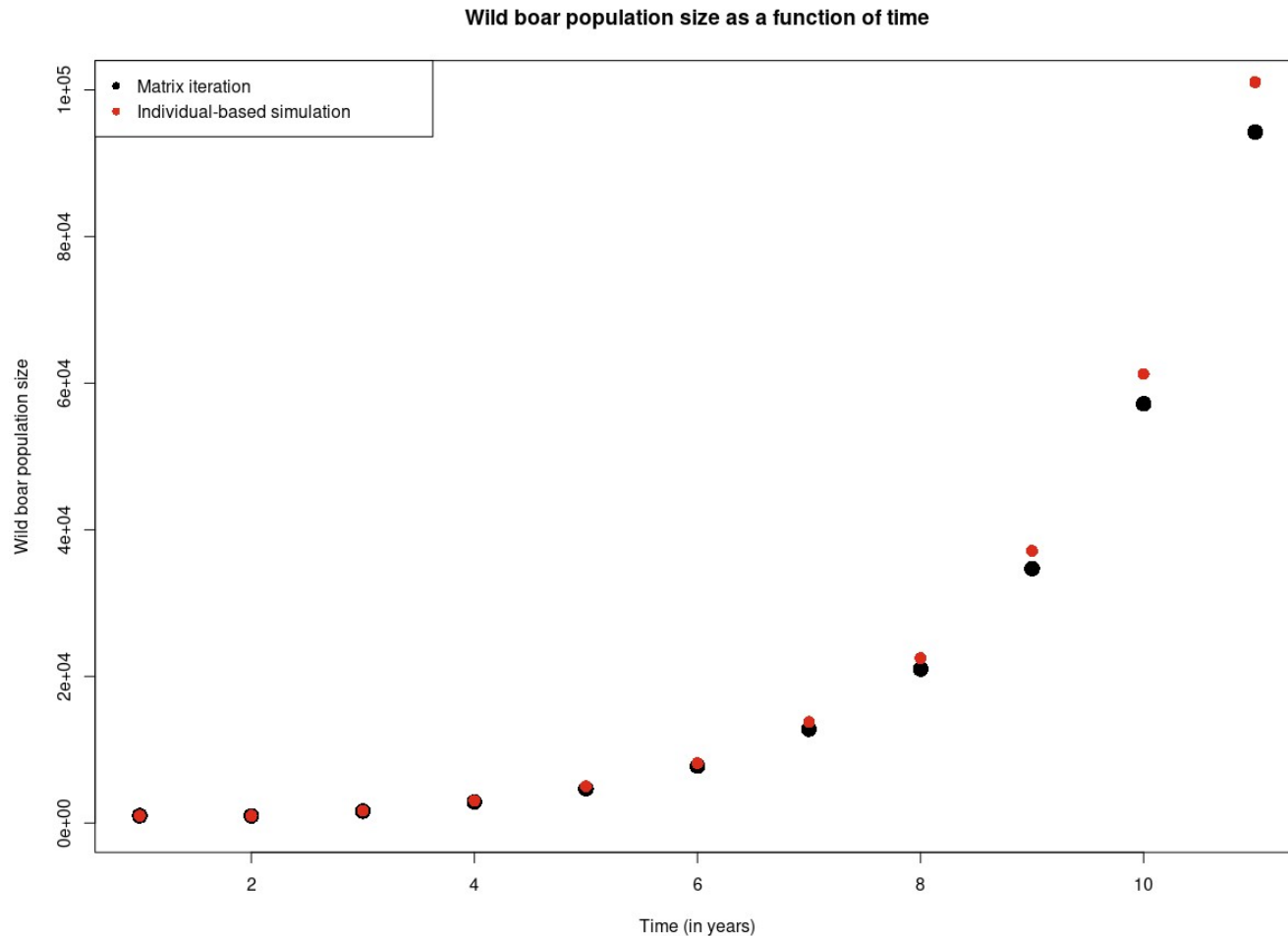
Vector of survival probabilities up to age a (given successful establishment):

$$l = c(0.8, 0.416, 0.2496, 0.177216, 0.12582336, 0.08933459)$$

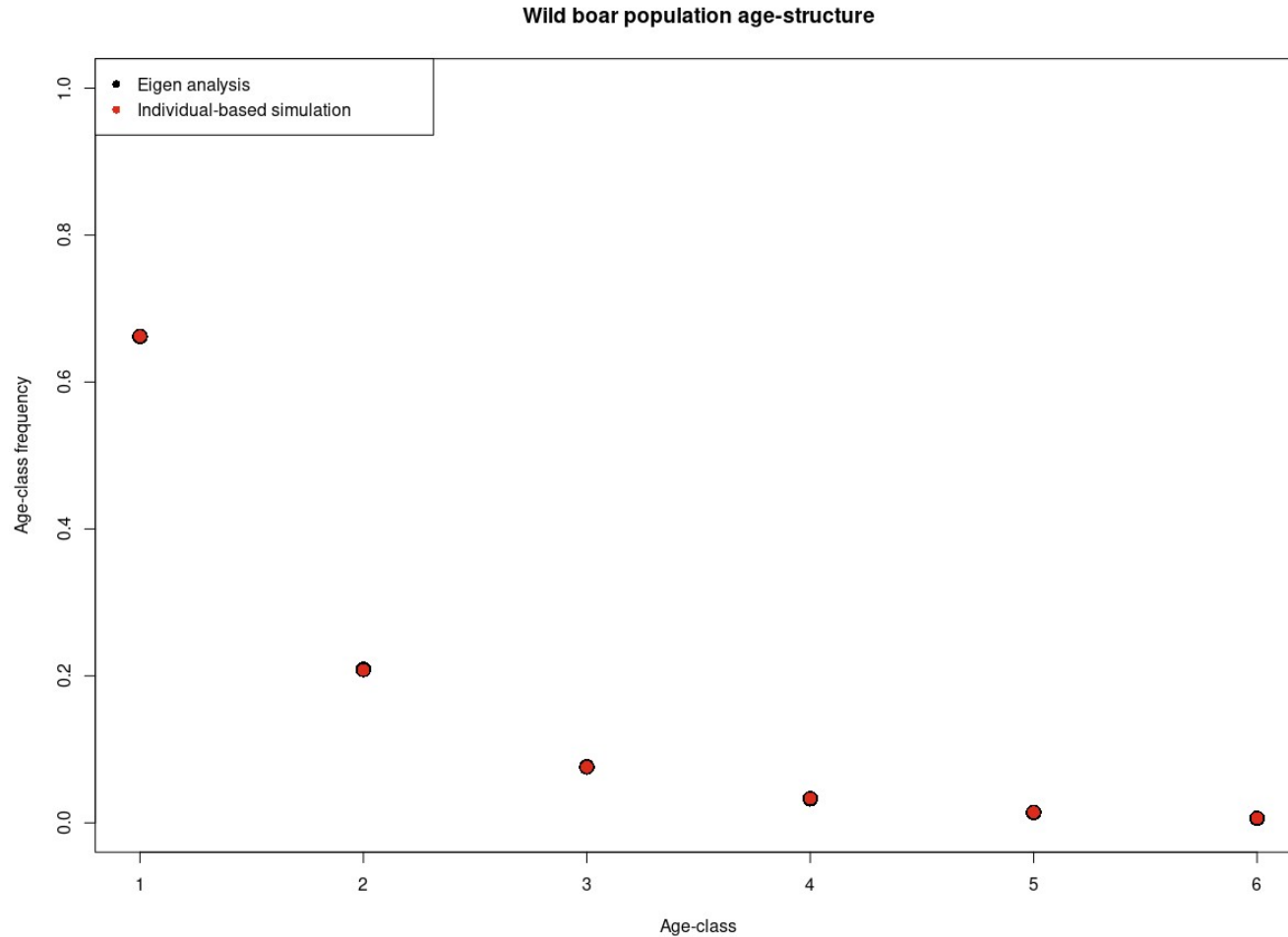
Computing R_0 :

$$R_0 = \text{sum}(l * f) = 4.057989$$

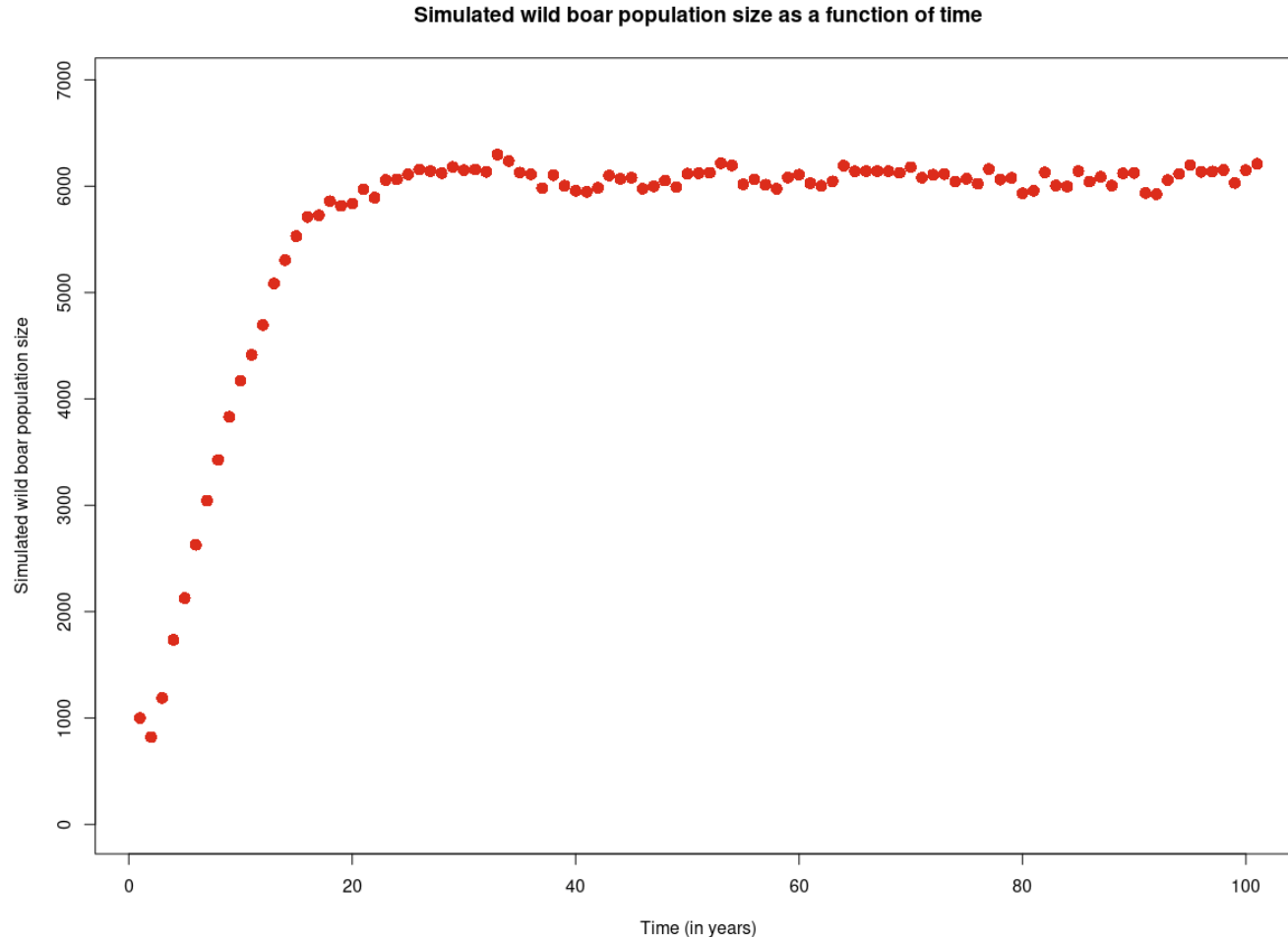
2.b. Simulated population size



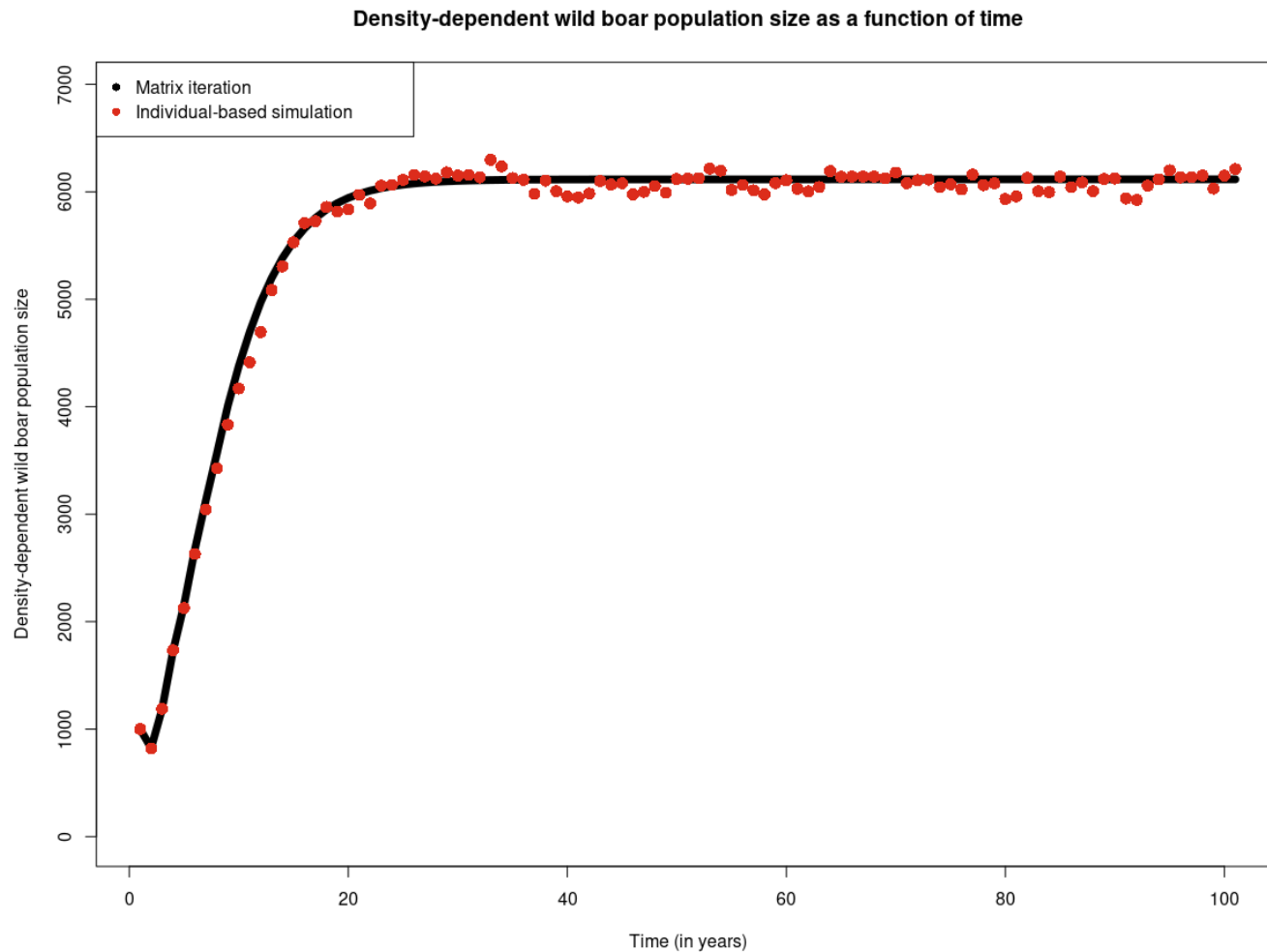
2.c. Age distributions



3.a. Density-dependent simulated population



3.b. Fit with Leslie matrix



3.c. R_0 as a function of time

