EVOLUTIONARY THINKING
TA SESSION WEDNESDAY

POPULATION GENETICS 1

AARHUS
UNIVERSITY
DEPARTMENT OF MOLECULAR BIOLOGY AND GENETICS

PLAN FOR TODAY

- Motivation for population genetics
- The Basic Coalescent (3.0)
- Exercises from the book chapter 1-3
- BREAK (15 MIN)
- Exercises from the book chapter 1-3
- ~13:30 evaluation of some of the exercises

MOTIVATION FOR THE STUDIES OF POPULATION GENETICS

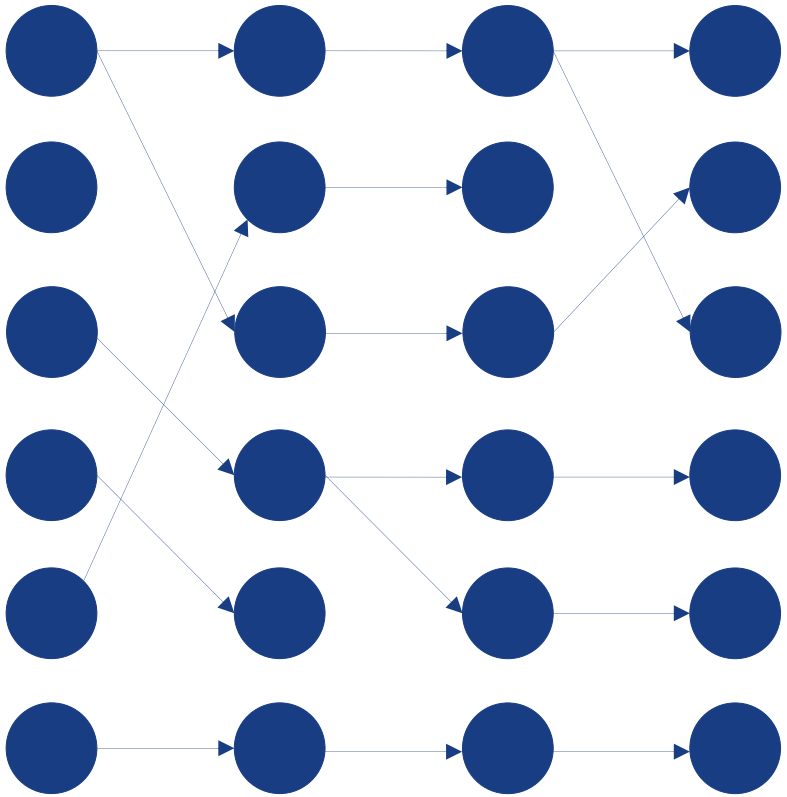
Evolution: Population genetics provides a framework for understanding how evolutionary change occurs, and it has helped us to identify the forces that drive evolution, such as natural selection, genetic drift, and gene flow.

Conservation: Population genetics can be used to assess the genetic health of populations and to identify populations that are at risk of extinction. This information can then be used to develop conservation strategies.

Agriculture: Population genetics can be used to improve crop yields and disease resistance by selecting for desirable traits.

Medicine: Population genetics can be used to identify genetic variants that are associated with diseases, and to develop new diagnostic tests and treatments.

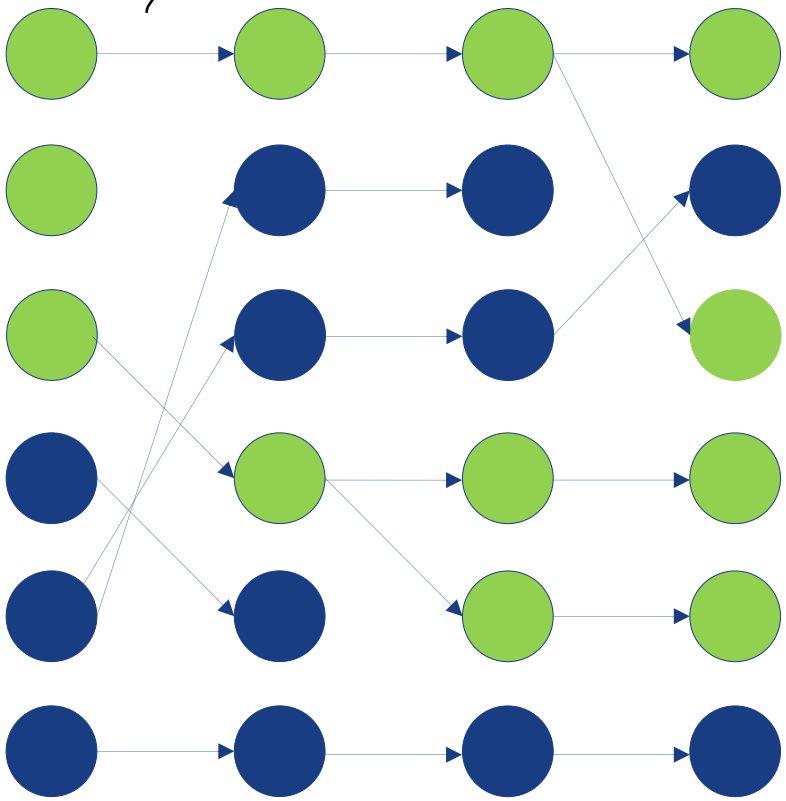
THE WRIGHT FISHER POPULATION



Assumptions

- Finite populations
- Non-overlapping generations
- Random mating

GENETIC DRIFT



What do we expect the allele freq. to be in the next gen

$$E[f_A(t+1)] = \frac{2N f_A(t)}{2N} = f_A(t)$$

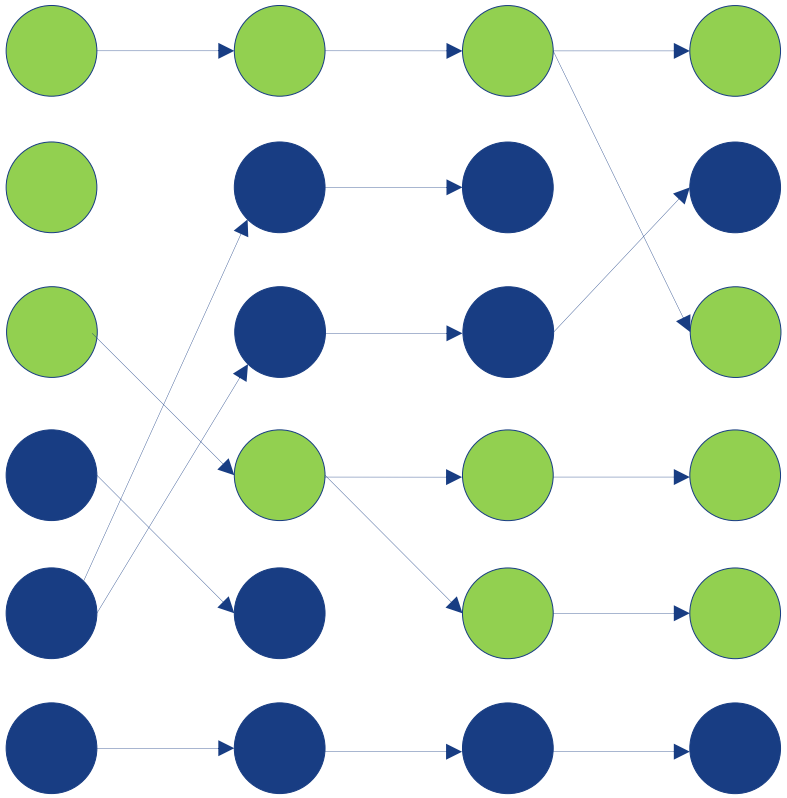
How likely is this outcome?

$$P\left(f_A(t+1) = \frac{2}{6}\right) = \binom{n}{x} * f_A\,(t)^x * \left(1 - f_A(t)\right)^{n-x}$$

$$= \binom{6}{2} * \left(\frac{1}{2}\right)^2 * \left(1 - \frac{1}{2}\right)^4$$

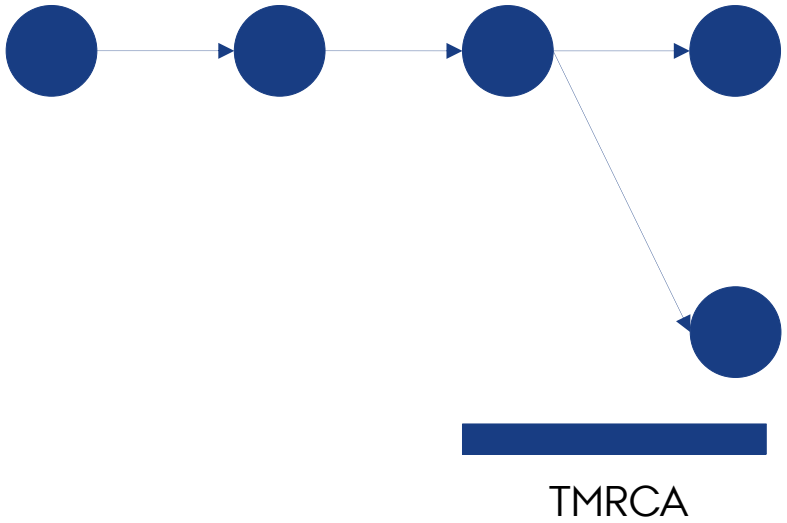
$$= 0.234$$

THE PROBABILITY OF FIXATION

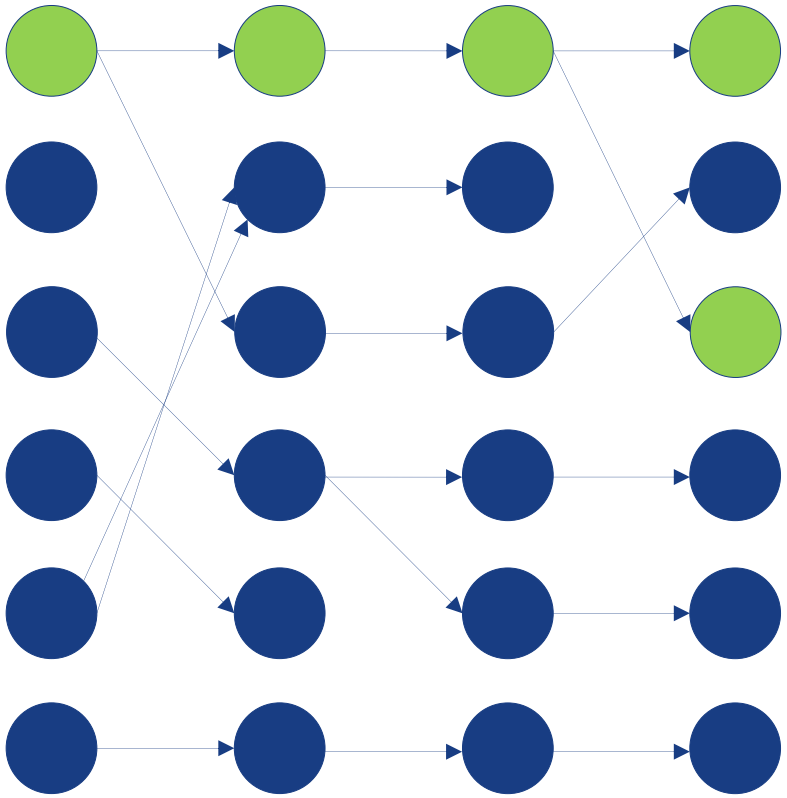


$$P(fixation\ of\ allele\ A) = N_A * \frac{1}{2N} = \frac{N_A}{2N} = f_A(t)$$

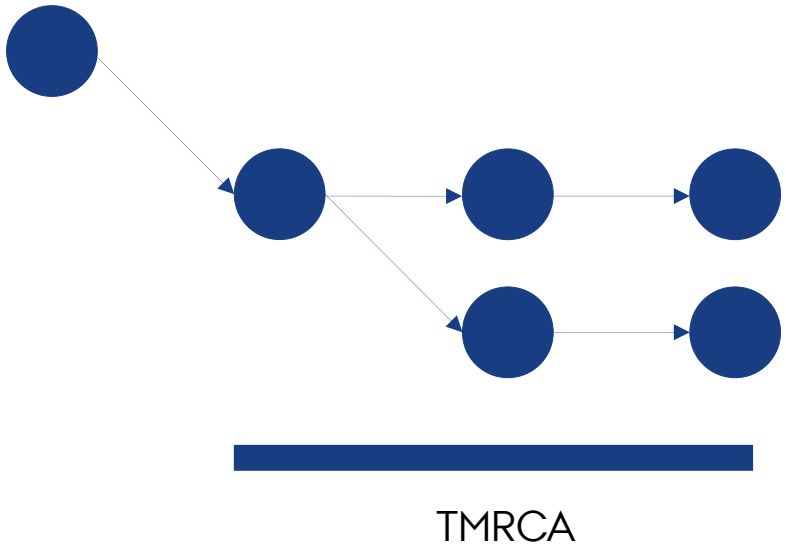
THE BASIC COALESCENT



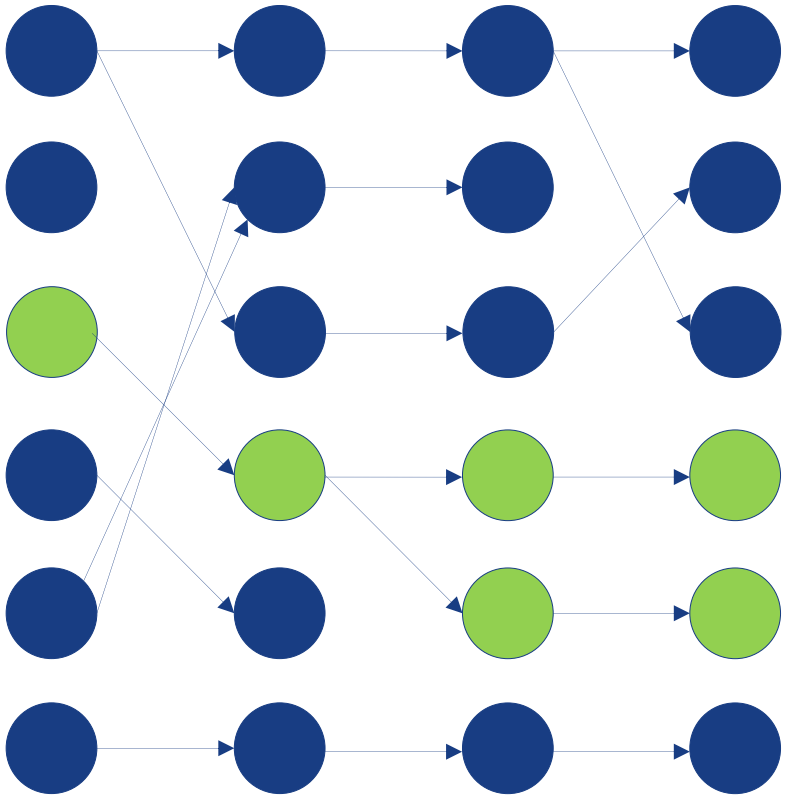
THE BASIC COALESCENT



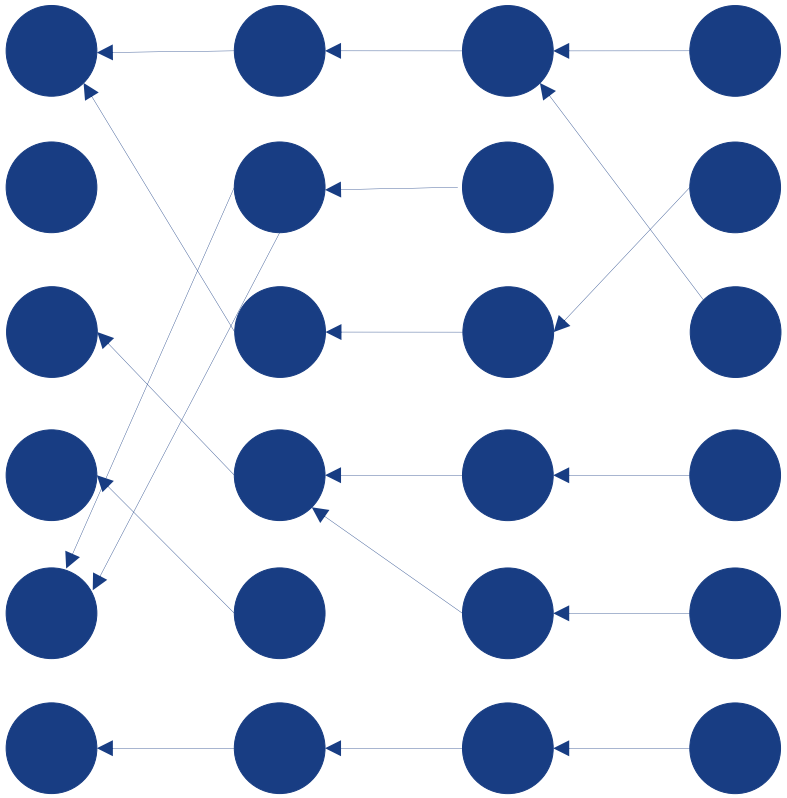
THE BASIC COALESCENT



THE BASIC COALESCENT



THE BASIC COALESCENT



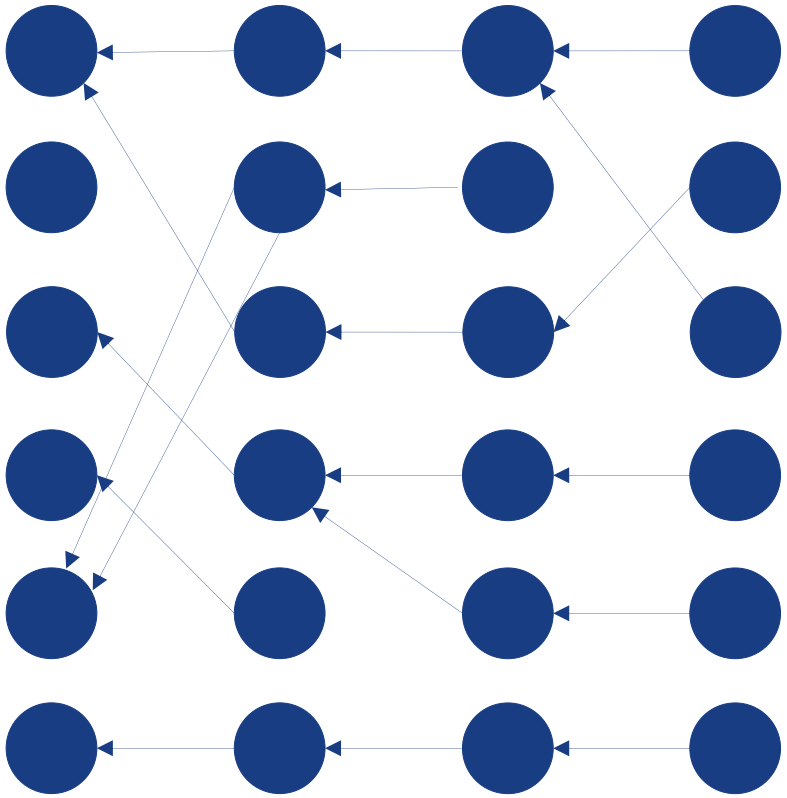
What is the probability that any 2 individuals coalesce in the previous generation?

$$2n * \frac{1}{2n} * \frac{1}{2n} = 1 * \frac{1}{2n} = \frac{1}{2n}$$

What is the probability not seeing any coalescent In the previous generation?

$$1 - \frac{1}{2n}$$

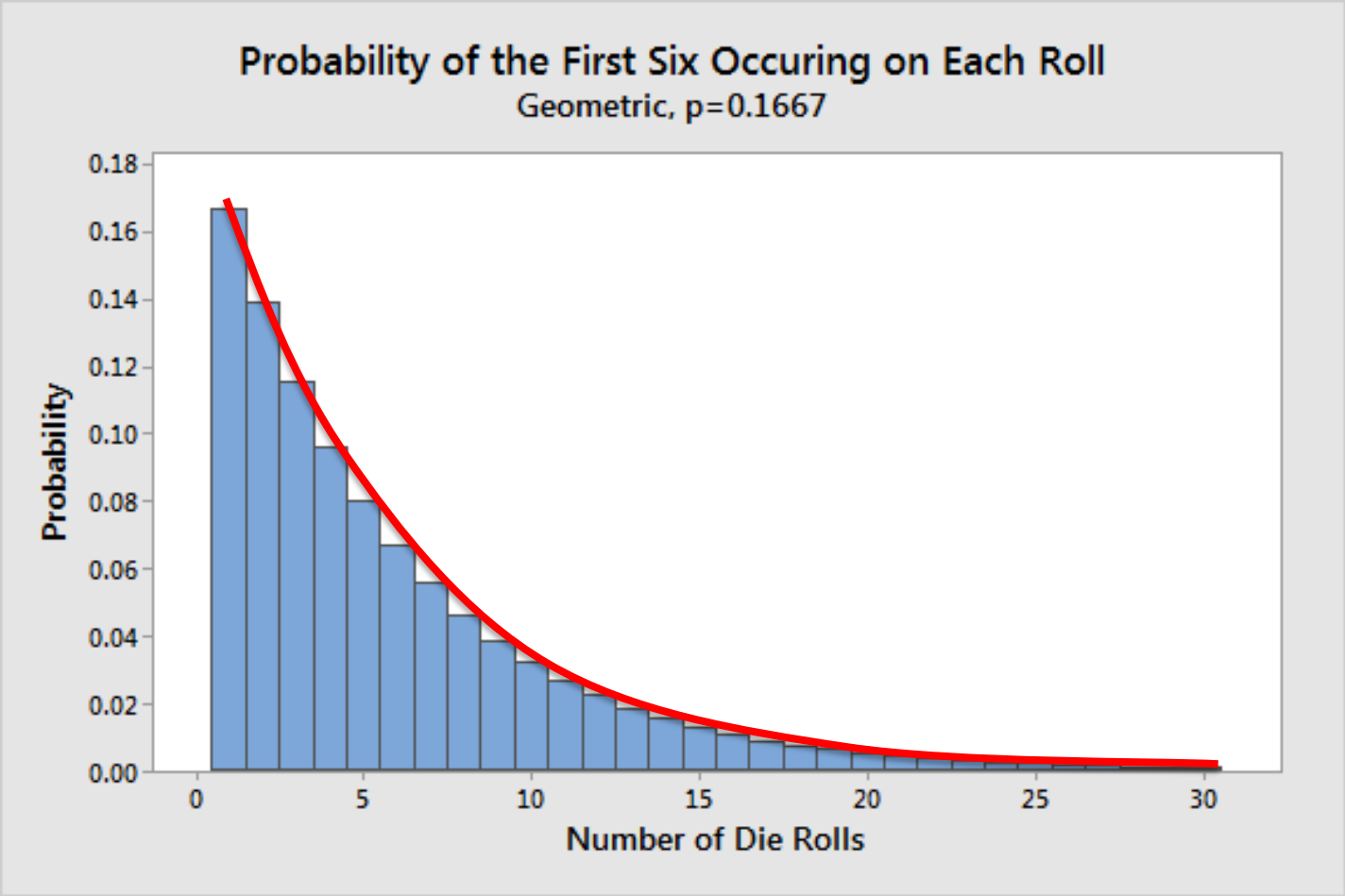
THE BASIC COALESCENT



Waiting time untill the first coalescent
Is geometrically distributed

Ananalogy might help understand

BACK TO THE DICE



Instead of the probability of $1/6$

The probability of coalescent at a specific generation is

$$P(Coalescent\ at\ generation\ r) = \left(1 - \frac{1}{2N}\right)^{r-1} \frac{1}{2N}$$

For the large N

$$P(Coalescent\ at\ generation\ r) = e^{-r/2N} \frac{1}{2N}$$

EXERCISES

Let do the ones you found

MENTI QUIZ OF THE WEEK

EVALUATION OF WEEK 38 AND 39

AARHUS
UNIVERSITY