Moran process

1. At each step of a Moran process ...
   (a) every individual reproduces once
   (b) the population size grows by one
   (c) the least fit individual always dies
   (d) one individual reproduces (proportional to fitness) and one is chosen uniformly to die

2. The fixation probability of a type is ...
   (a) the probability the population eventually consists entirely of that type
   (b) the probability the type dies out
   (c) the fraction of the population it starts with
   (d) its fitness divided by the average fitness

3. Under neutral drift (a mutant of the same fitness as residents), a single mutant fixes with probability ...
   (a) $1/N$
   (b) 0
   (c) $1/2$
   (d) 1

4. A Moran process with two types has ...
   (a) two absorbing states: all of one type or all of the other
   (b) no absorbing states
   (c) an absorbing state at every population split
   (d) exactly one absorbing state

5. For an advantageous mutant with relative fitness $r > 1$, as $N \to \infty$ the fixation probability tends to ...
   (a) $1 - 1/r$, which is bounded away from 1
   (b) 1
   (c) $1/N$
   (d) 0

6. The relative fitness r of a mutant is ...
   (a) the size of the population
   (b) the number of mutants
   (c) the probability it dies

(d) its fitness divided by the resident fitness

7. In a game-based Moran process, the fitness of an individual depends on ...
   (a) only its own type
   (b) the composition of the whole population (its payoff in the current state)
   (c) nothing; all fitnesses are equal
   (d) the round number
8. Selection in the Moran process acts through ...
   (a) the population size
   (b) the birth step: fitter individuals are more likely to reproduce
   (c) neither step
   (d) the death step: fitter individuals are more likely to die
9. The death step of the Moran process chooses an individual ...
   (a) that just reproduced
   (b) uniformly at random
   (c) with the lowest fitness
   (d) proportional to fitness
10. The two-type fixation formula uses the ratios γ_i defined as ...
    (a) the fitness of type 1
    (b) the population size
    (c) $p_{i,i-1}/p_{i,i+1}$, the down-step over up-step probabilities
    (d) $1/N$
11. Under strong selection ($w = 1$) ...
    (a) the process never fixes
    (b) fitness equals the raw payoff, so payoff differences act at full strength
    (c) all fitnesses are equal
    (d) the population grows
12. The boundary conditions for the fixation probability are ...
    (a) $\rho_0 = \rho_N = 1/N$
    (b) $\rho_0 = 1$ and $\rho_N = 0$
    (c) $\rho_0 = \rho_N = 1/2$
    (d) $\rho_0 = 0$ and $\rho_N = 1$

13. A single mutant is favoured by selection when its fixation probability satisfies ...

    (a) $\rho_1 > 1/N$

    (b) $\rho_1 = 0$

    (c) $\rho_1 = 1$

    (d) $\rho_1 < 1/N$

14. The Moran process is repeated until ...

    (a) a fixed number of steps have passed

    (b) the population doubles

    (c) every individual has reproduced once

    (d) only one type remains in the population

15. A disadvantageous mutant ($r < 1$) has a fixation probability that is ...

    (a) exactly 1

    (b) above the neutral value $1/N$

    (c) exactly $1/2$

    (d) below the neutral value $1/N$

16. The two-type fixation probability is $\rho_i = \dfrac{1 + \sum_{j=1}^{i-1} \prod_{k=1}^{j} \gamma_k}{1 + \sum_{j=1}^{N-1} \prod_{k=1}^{j} \gamma_k}$, where γ_k equals ...

    (a) the mutant fitness alone

    (b) $1/N$

    (c) $f_R(k)/f_M(k)$, the resident-to-mutant fitness ratio

    (d) $f_M(k)/f_R(k)$

17. In a constant-fitness process with mutant fitness r and resident fitness 1, the ratio γ_k is ...

    (a) r for every state k

    (b) different in every state

    (c) r^{-1} for every state k

    (d) equal to $1/N$

18. Weak selection in the Moran process corresponds to a selection intensity w that is ...

    (a) close to 0

    (b) close to 1

    (c) negative

    (d) greater than N

19. Throughout a Moran process the total population size ...

    (a) shrinks over time

    (b) grows by one each step

    (c) fluctuates randomly

    (d) stays constant at N, since each birth replaces a death

20. Neutral drift is the special case of the Moran process in which the relative fitness is ...

    (a) $r > 1$

    (b) $r = 0$

    (c) $r < 1$

    (d) $r = 1$