Formalize the types of problems from last time:

* *Xn*denotes the population size at the beginning of day *n.*

Suppose at the beginning of day 0, the population has size 1

*X0* = 1.

Assumption 1. Suppose that each day there are 2 births.

|  |  |  |
| --- | --- | --- |
| 1 (+2 births) | 3 (+2 births) | 5(+2 births) |
| N = 0 | N=1 | N=2 |

Q. How many individuals are there at the beginning of day 1, day 2, or day 3?

X0= 1

X1= 3

X2= 5

X3=7

(Linear: +2)

(1, 3, 5, 7, …)

Assumption 2. Suppose instead that there are 3 births per individual at the beginning of the day. ((if there are 2 individuals at the beginning of the day, there are 6 births that day))

and 1 death per individual.

|  |  |  |
| --- | --- | --- |
| 1 + (2\*1) | 3 +(2\*3) | 9 +(2\*9) |
| N = 0 | N=1 | N=2 |

Q. How many individuals are there at the beginning of day 1, day 2, day 3?

X0= 1

X1 = 3

X2 = 9

X3 = 27

(Exponential X1= 3\*X0)

**Difference Equation.**

Xn+1 = xn + 3xn – xn

Xn – xn-1 = 2xn

…

Xn= 3n x0