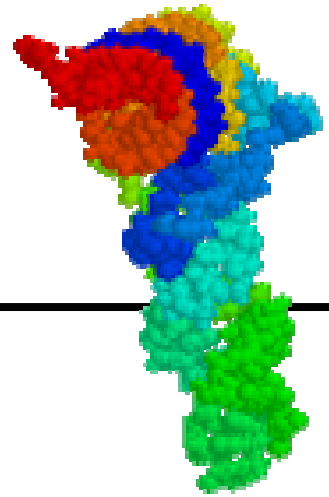
Genomics, Computing, Economics & Society



10 AM Tue 27-Sep 2005

MIT-OCW Health Sciences & Technology 508/510

Harvard Biophysics 101

Economics, Public Policy, Business, Health Policy

Class outline

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(1) Topic priorities for homework since last class

(2) Quantitative exercise

(3) Project level presentation & discussion

(4) Sub-project reports & discussion

(5) Discuss communication/presentation tools

(6) Topic priorities for homework for next class

(1) Topic priorities for homework since last class

(a) Your notes at top level and detailed level

(b) Follow up on the discussion on Thu: What is life?
Definitions of random and complex
Statistical complexity, replicated complexity
Compression algorithms
Examples of test cases.

(c) Exponential growth xls example

Test cases for bio-complexity

Static vs dynamic

- Snowflakes
- Mule
- Fire
- Brain-dead
- cloned beings, parts recreating whole- cells
- ecosystem - green animals symbionts
- Plant clippings (soil-dead)
- symmetry of plants & animals, Fibonacci
- gas vs crystals
- complexity function of size
- Economic systems
- Cellular Automata, Univ-Turing machines
- Logistical map
- Autonomous agents
- Quantum, crypto randomness, incompressible
- Chemical vs structural complexity
- Ideas - Language - memes
- viruses, DNA
- computer viruses
- religion & science memes
- Collections of ideas & cultural artefacts (books)

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Meta-definition issues for bio-complexity

- Static vs dynamic
- Environmental conditions
- Density 3 or 4 D
- Hidden simple processes random seed vs pi
- functional vs imperative languages (Walter)
- In/out complexity
- Stan Miller & origin of life
- Adjacent possible (Kaufman)
- Rate of complexity change (4th law?)
- anthropocentrism biocentrism

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What are random numbers good for?

- Simulations.
- Permutation statistics.

Where do random numbers come from?

$X \in \{0,1\}$

perl -e "print rand(1);" 0.116790771484375
0.8798828125 0.692291259765625 0.1729736328125

excel: = RAND() 0.485394999892640 0.639168527899398 0.100949785309836 0

f77: write(*,'(f29.15)') rand(1) 0.513854980468750
0.175720214843750 0.308624267578125

Mathematica: Random[Real, {0,1}] 0.747429327436969 4
0.508179411314901 1 0.024233896384510 16

Where do random numbers come from really?

Monte Carlo.

Uniformly distributed random variates X_i = remainder(aX_{i-1} / m)

For example, a= 7^5 m= 2^{31} -1

Given two X_j X_k such uniform random variates,

Normally distributed random variates can be made

(with $\mu_X = 0$ $\sigma_X = 1$)

X_i = sqrt(-2log(X_j)) cos($2\pi X_k$) (NR, Press et al. p. 279-89)

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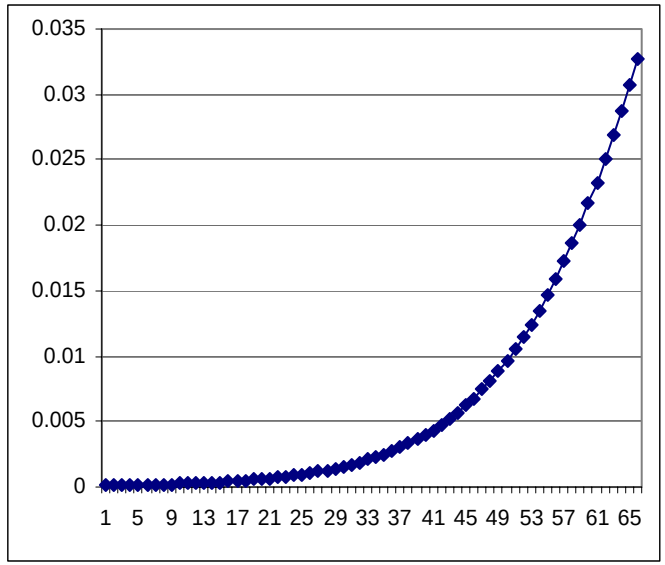
Exponent.xls



A3 =MAX(r*A2*(1-A2),0)

try r= 0.9, 1.01, 1.1, 1.5, 3, 3.67859, 4, 4.03

try y(i) =r*y(i-1) (i.e. A3=r*A2 etc.)

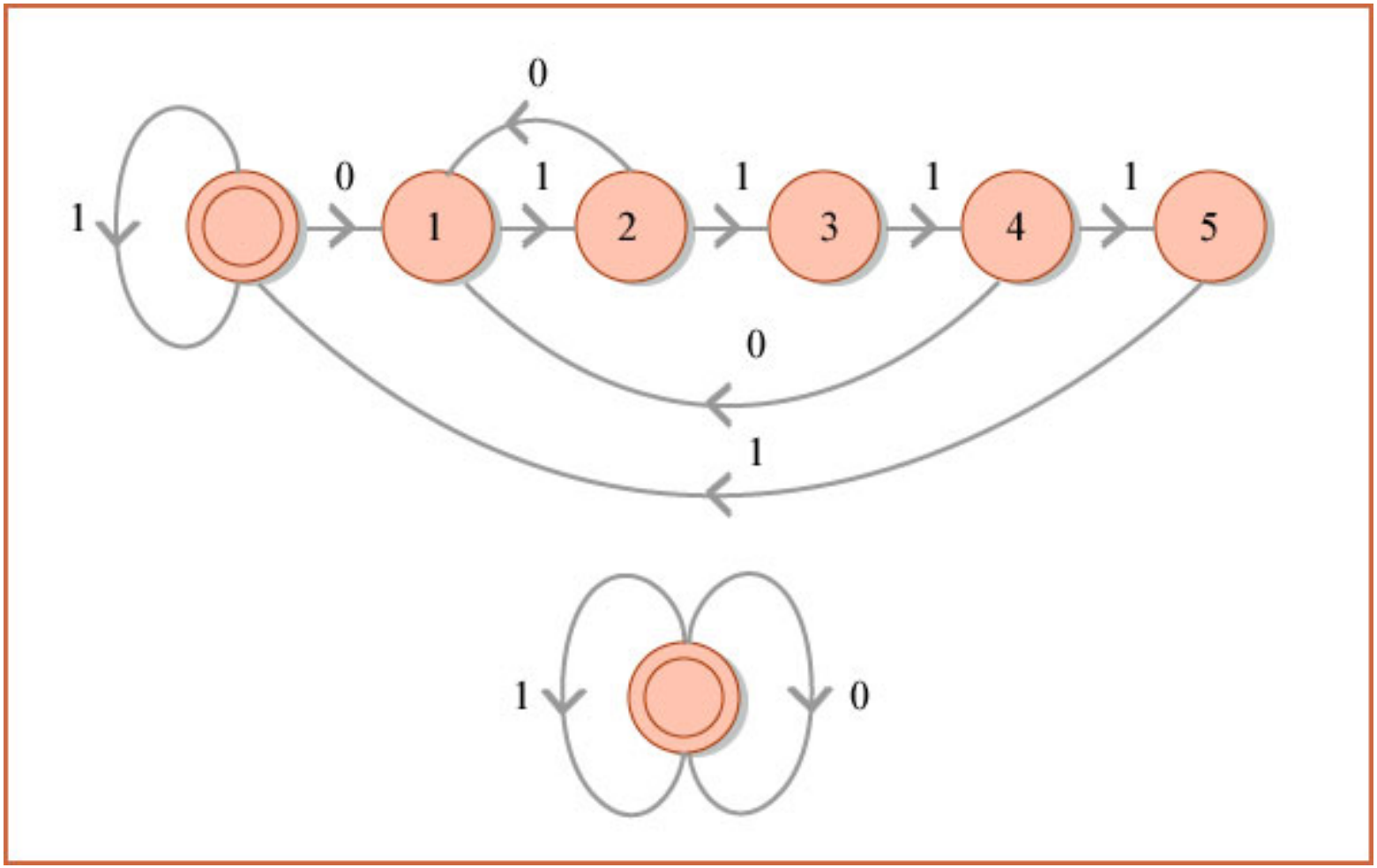


Figure by MIT OCW.