Introduction to Complexity (2020)

4.9 Take Unit 4 Test » Unit 4 Test

Instructions 1

You may use any course materials, websites, Netlogo models, calculators, etc. for this test. Just don't ask another person for the an share your answers with other people.

Question 2

Leo Szilard's resolution of the Maxwell's demon paradox stated that:

- A. The demon proposed by Maxwell would be too small to correctly measure the speed of a moving molecule.
- B. The demon's opening and closing of the door provides the work required to account for the reduction of entropy in the system.
- C. The demon's act of acquiring information (i.e., the speed of the molecules) provides the work required to account for the reduction of entropy in the systen
- D. The second law of thermodynamics is incorrect if observers (like the demon) are taken into account.

Question 3

Recall the three-window slot machine example described in Unit 4. 3. Recall that a microstate is a specific set of three fruits (one in window), and that we calculated that there are 125 possible microstates, since there are five possible fruits that could show up in ea and 5 x 5 x 5 = 125. How many possible microstates would there be for a slot machine with **four** windows, and **three** possible fruits show up in each window?

- A. 125
- B. 27
- C. 81
- D. 128
- E. 256

Question 4

For a message source that can emit two possible messages, "0" and "1", the highest possible Shannon information content occurs w

- A. "0" and "1" are emitted with equal probability
- B. "0" is more probable than "1"
- C. "1" is more probable than "0"
- D. "1" is never emitted

Question 5

Consider a fair twelve-sided die:

If this die is consider a message source, and a roll of the die is considered a message, what is the Shannon information content of th source?

- A. $\log_{10} 12$
- B. $\log_{12} 12$
- C. $1/12 \log_2 12$
- D. $\ln 12$
- E. $\log_2 12$

Question 6

Suppose you have two biased coins, Coin A, which comes up heads 90% of the time, and Coin B, which comes up heads 55% of the consider each independently as a message source, which one will have the **higher** Shannon information content?

- A. Coin A
- B. Coin B

Question 7

Which will have higher Shannon information content: A fair six-sided die or a fair 12-sided die?

- A. 6-sided die
- B. 12-sided die

Question 8

Recall that the logistic map is $x_{t+1} = R\, x_t (1 - x_t)$

Consider the symbolic dynamics of the logistic map, described in Unit 4.5. This is a "message source" that iterates the logistic map, time step outputs "1" if x_{t+1} is greater than 0.5, and "0" otherwise.

Which of the R values listed below produce a message source with the highest information content? (Note: You don't need to run th model to figure this out.)

- A. $R = 1$
- B. $R = 2$
- C. $R = 3$
- D. $R = 4$

Question 9

Claude Shannon's main purpose in developing his information measure was to:

- A. Measure the information content of English text.
- B. Unite thermodynamics and statistical mechanics.
- C. Understand how to transmit information such as telephone signals more efficiently.
- D. Understand how to best design cell-phone networks
- E. Show that the second law of thermodynamics is valid