Introduction to Informatics

Just the facts m’am:
Exam Questions
Exam Schedule

- 17707 (M/W Class)
  - Final Exam
    - May 3rd (Wednesday)
    - 5:00-7:00 p.m.
    - Ballantine Hall: BH 109
  - Extra Office Hours
    - Monday, Class time
      - Eigenmann 905

- 17712 (T/R Class)
  - Final Exam
    - May 4th (Thursday)
    - 2:45-4:45 p.m.
The Nature of Information

Symbols and Information Quantity
Questions

- What is informatics?
- What is the difference between an "index" and an "symbol"?
- Examples of Analogue vs. Digital Information?
- How does Information Technology relate to semiotics?
Technology

Tools, Cyborgs and History of IT
Questions

1. Describe the Hertz Modelling Process
2. What are Boids and how do they work?
3. Propose a L-System Rule to draw the following artificial plant
Data Representation

Encoding the World

Pixels: picture elements
Questions

- What is a positional number system? Give an example of a number system that is not positional, and an example of one that is positional.
- Convert 1001001101.01 from binary to decimal. Please show your calculations.
- What is the ASCII encoding of the word TURING (Uppercase) in Decimal?
  - 84 85 82 73 78 71
  - 73 78 70 79 82 77 65 84 73 67 83
  - 65 82 73 83 84 79 84 76 69
  - 65 83 67 73 73 50
- How many bytes do you need to encode a bitmap figure with resolution 300 x 600 using the RGB format?
  - 960,000
  - 180,000
  - 480,000
  - 540,000
Deductive Modeling

Logic, Sets, Deduction

Logic: another thing that penguins aren't very good at.
Questions

- Build the truth tables of the following:
  - $\neg\neg a$
  - $a \land (b \land \neg a)$
  - $(a \Rightarrow b) \Rightarrow \neg b$
- Given a Universal Set $X = \{0, 1, 2, 3, 4, 5\}$, let $A = \{0,1,2\}$, $B = \{2,3,4\}$ and $C = \{1,2,3,5\}$.
  - Show that $(A \cap B) \cup C \neq (A \cup B) \cap C$
  - Express $\{5\}$ in terms of $A$, $B$, and $C$ using set operations
  - Express $\{2\}$ in terms of $A$, $B$, and $C$ using set operations
Inductive Modeling

Statistics, Probability, Fitting Data, Induction
Questions

- Over a 20-game period, the number of hits by a baseball player was 1,2,0,0,1,2,2,1,0,0,4,0,1,1,3,2,1,3,0, and 1
  - Construct the Frequency distribution
  - In what proportion of games did he get at least 3 hits?
  - What is the mean, median, and mode
- What is the line that best fits the data with the least squares criterion?
- A coin is tossed three times and an H or T (H= Head, T=Tail) is recorded each time.
  - List the elements of the sample space S and list the elements of the event consisting of
    - All heads
    - A head on the second toss
    - Two tails
  - Represent the sample space and the events above as a Venn Diagram
- One card is to be selected from an ordinary deck of 52 cards. Find the probability that
  - The selected card is an ace
  - The selected card is not a 9
Uncertainty

Hartley and Shannon Information

"Do you think they mean us?"
Questions

- What type of Uncertainty does the Hartley measure of uncertainty measure?

- What are the units of Shannon entropy?

- Does Shannon’s information theory deal with the semantics and pragmatics of a message? Please explain why?

- If we have a symbol set \( X = \{A, B, C, D, E\} \) where the symbol occurrence frequencies are:
  - \( A = 0.5 \)
  - \( B = 0.2 \)
  - \( C = 0.1 \)
  - \( D = 0.1 \)
  - \( E = 0.1 \)

  If we know that a message is being sent in this language, what is the average minimum number of bits needed to guess the next symbol of the message?
Questions

- Using pseudo-code, write down an algorithm to calculate the tip of a restaurant bill and the amount that each person of a group of \( n \) needs to pay.

- Consider the following recursive definition of a function:
  \[
  Q(n) = Q(n - Q(n-1)) + Q(n - Q(n - Q(n-2)))
  \]
  for \( n > 2 \)

  - with \( Q(1) = Q(2) = 1 \).

  - Please write down a pseudo-code algorithm to calculate \( Q(10) \).

- What is the Bremermann's Limit?

- Discuss its implications to problem solving and modeling.
Data Modeling

Entity-relationship model and Relational Databases
Questions

The Santiago de Compostela historical society is setting up a database of the monarchs in the “unified” Spain. This is a chronological list of the people who have ruled “unified” Spain; the dates given are the periods of said rule.

Unified ‘Spain’

- **Habsburg Dynasty**
  - 1516 - 1556 Charles I (Emperor Charles V), King of Spain, Austria, Netherlands, Rome and Naples
  - 1556 - 1598 Philip II, King of Spain, Portugal, Austria, Netherlands, Rome and Naples
  - 1598 - 1621 Philip III, King of...
  - 1621 - 1665 Philip IV
  - 1665 - 1700 Charles II

- **Bourbon Dynasty**
  - 1700 - 1724 Philip V
  - 1724 Louis I
  - 1724 - 1746 Philip V (2nd time)
  - 1746 - 1759 Ferdinand VI
  - 1759 - 1788 Charles III
  - 1788 - 1808 Charles IV
  - 1808 Ferdinand VII

- **French Rule**
  - 1808 - 1813 Joseph Bonaparte

- **Bourbon Dynasty**
  - 1814 - 1833 Ferdinand VII
  - 1833 - 1868 Isabella II
  - 1874 - 1885 Alfonso XII
  - 1886 - 1931 Alfonso XIII
  - 1975 - present Juan Carlos I

The society has already decided to include the fields above. Please describe the entities and their attributes of each field in the database.
Informatics at IU

Humans

Information

Technology

SPEED LIMIT C
Luis M. Rocha and Santiago Schnell

Brought to you by

Cyber Rhapsody

Or Infernal Beast From The Air Dimension ???