Introduction to Informatics

Just the facts m'am:

Exam Questions

Luis M.Rocha and Santiago Schnell

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

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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

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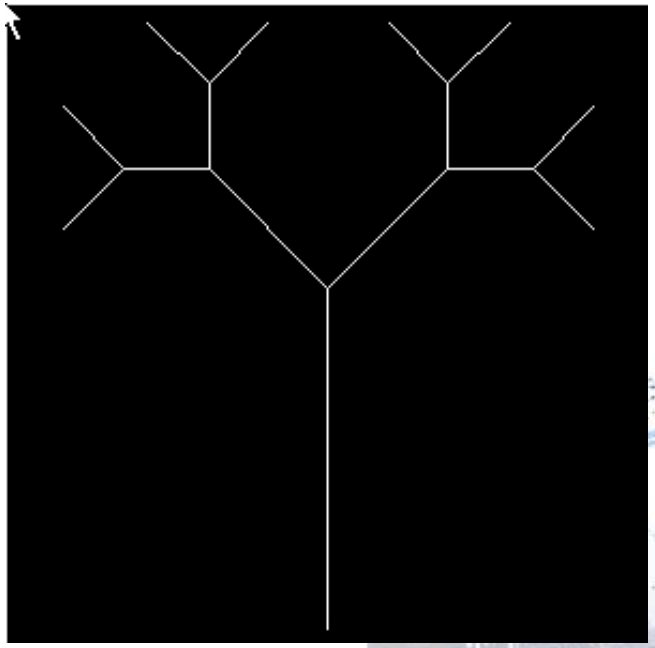
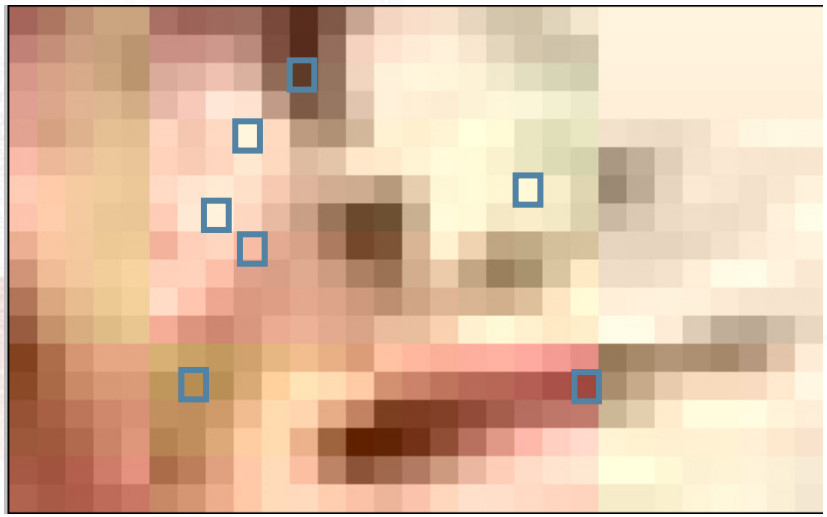
Questions

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

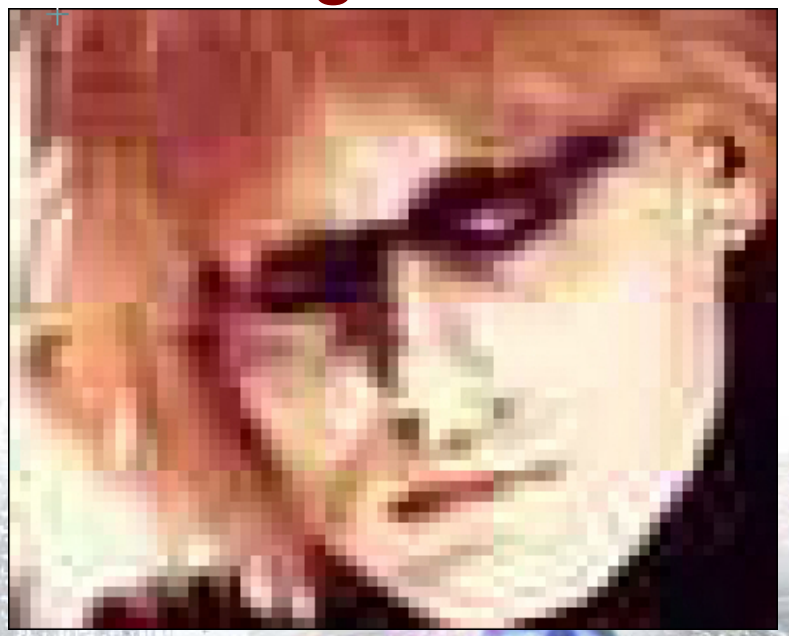


Data Representation



Pixels: picture elements

Encoding the World



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

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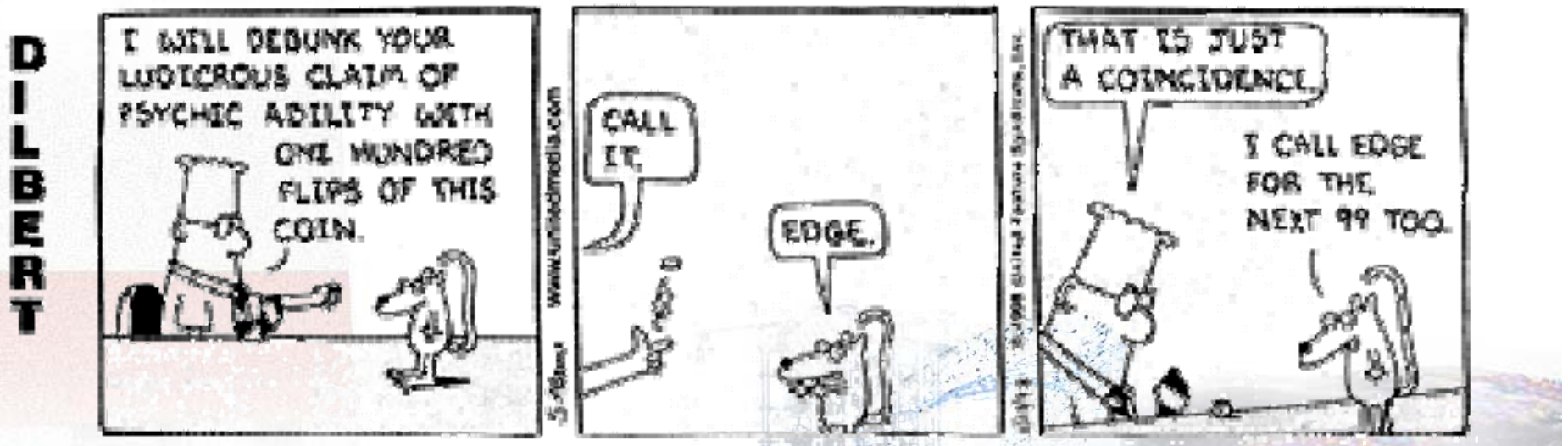
Questions

- Build the truth tables of the following:
  - $\neg\neg$ a
  - a $\wedge$ (b $\wedge \neg$ 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



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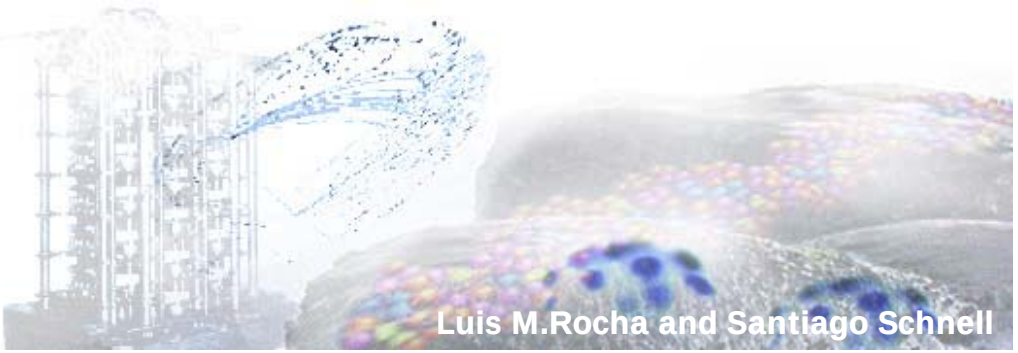
Questions

- 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



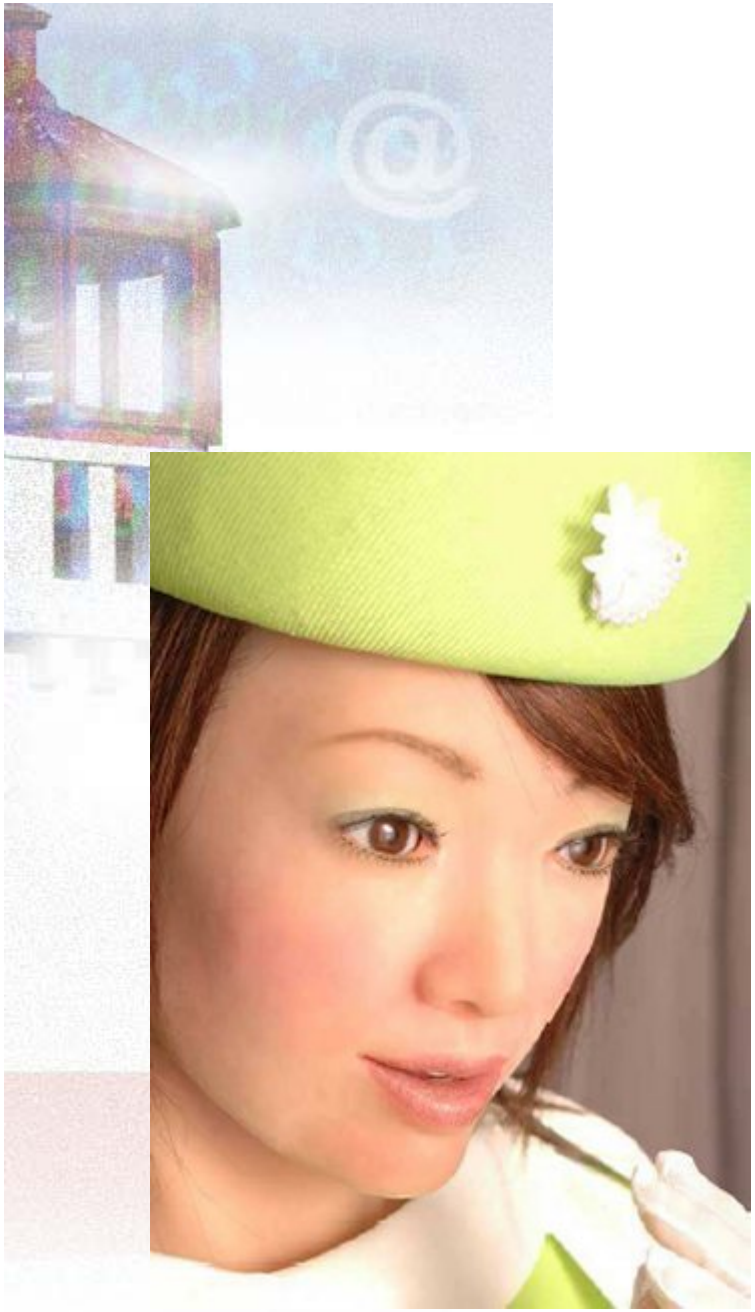
Uncertainty

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?



Algorithms

Pseudo-code and Flow Charts

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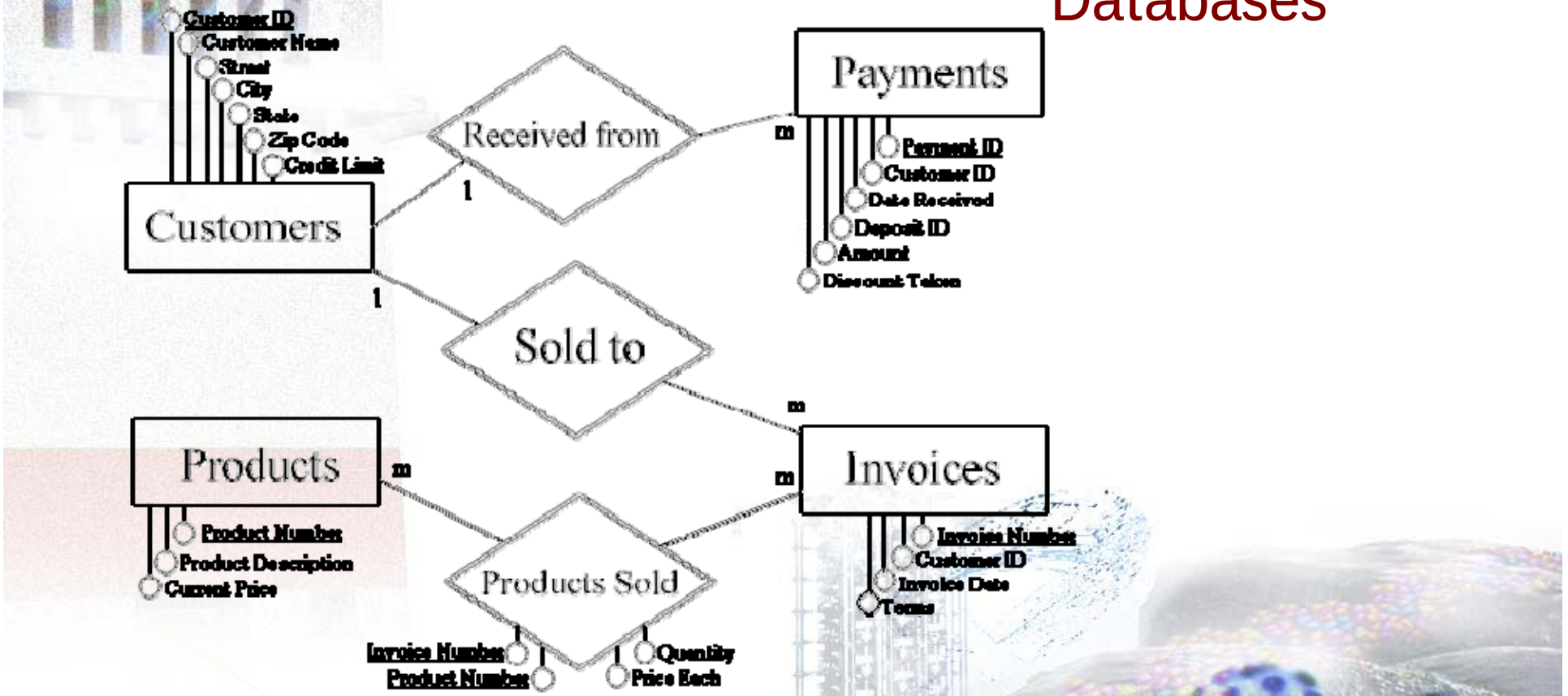
Questions

- Using pseudo-code, write down an algorithm to calculate the tip of a restaurant bill and the amount that each person of a group o *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

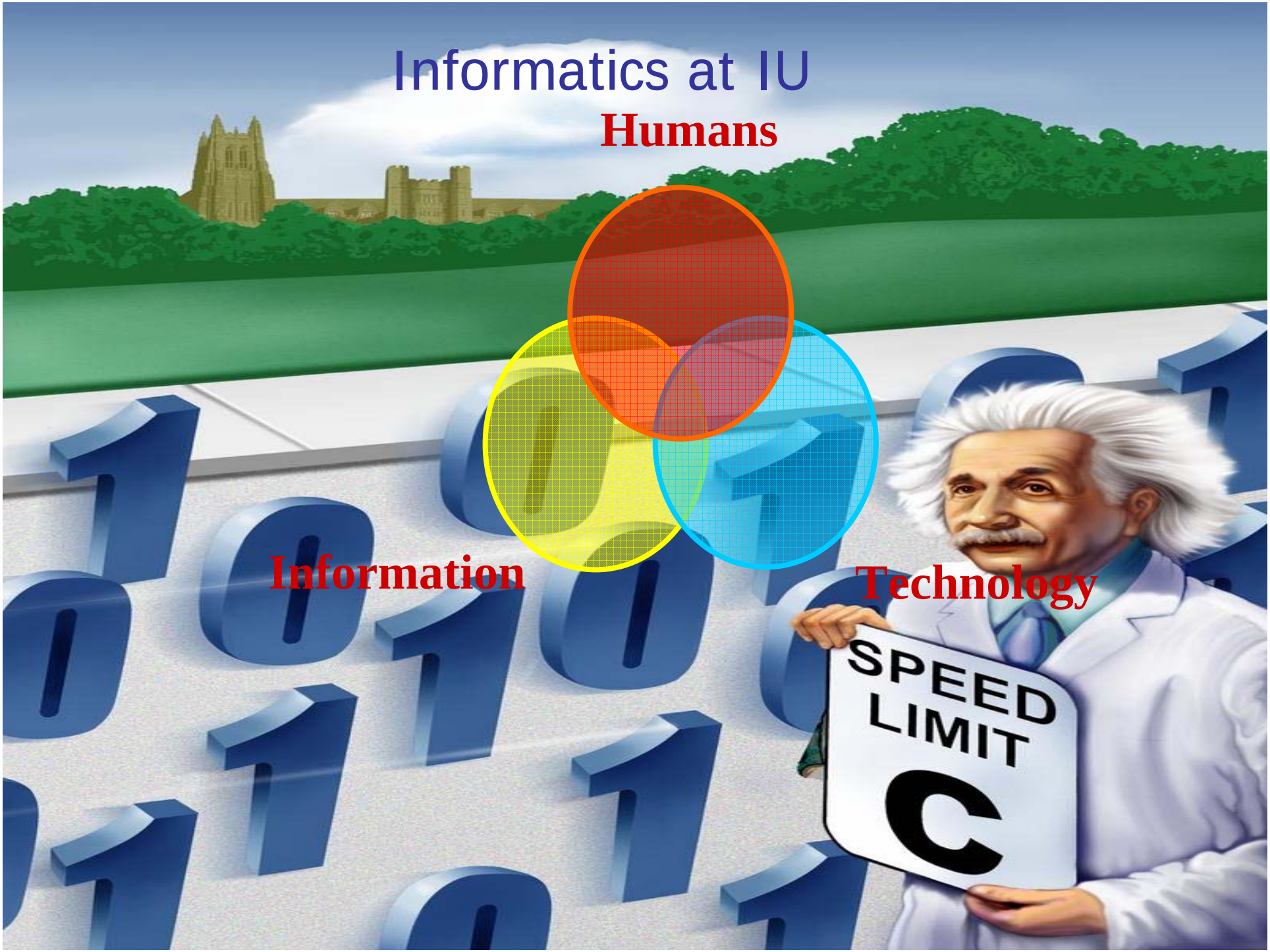
Entity-relationship model and Relational Databases

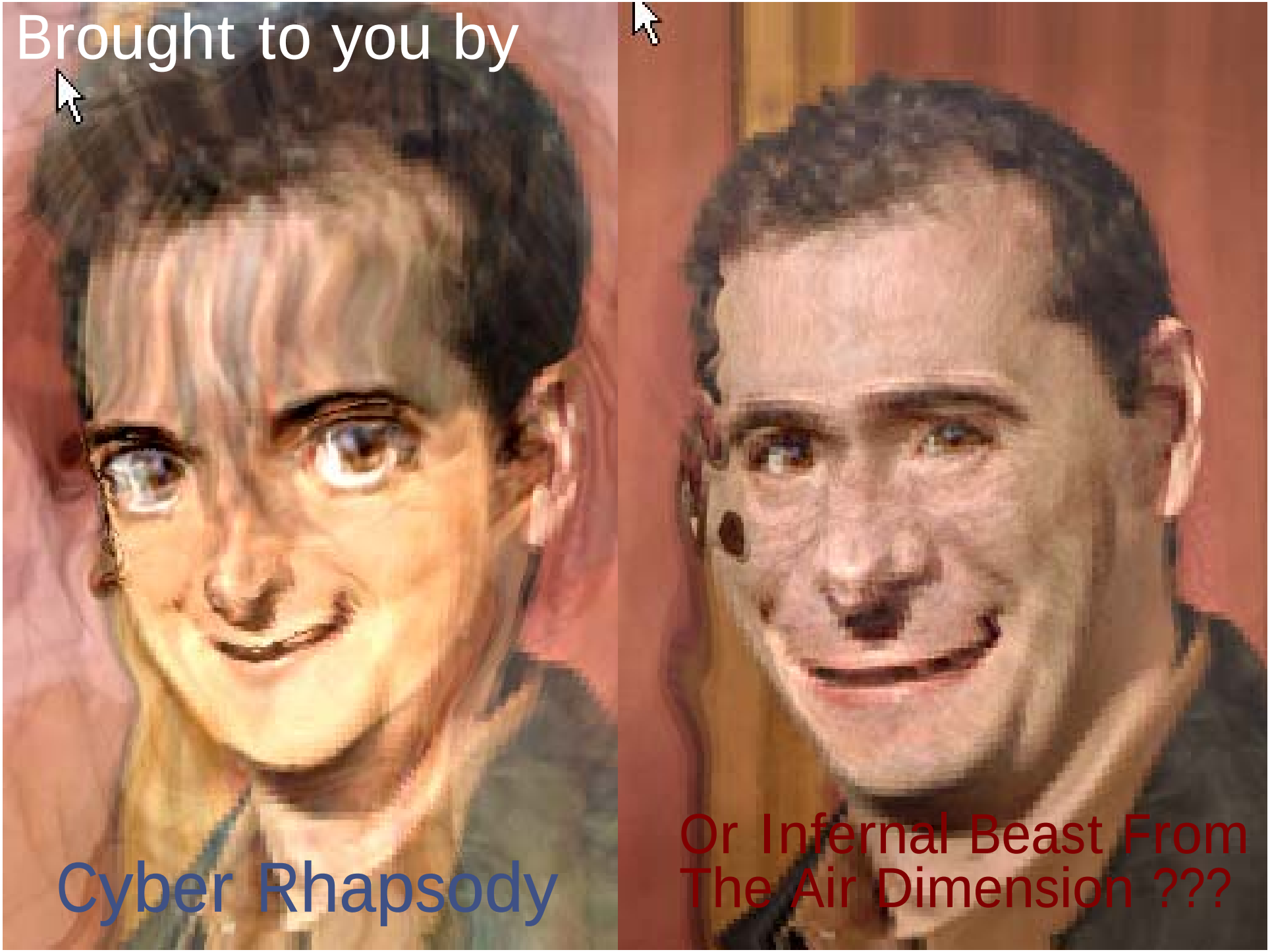


Questions

- 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

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Cyber Rhapsody
Or Infernal Beast From The Air Dimension ???