**Midterm Review**

**Midterm logistics**
- time: 75 min
- materials allowed: open book
- hybrid approach, two parts
  - Canvas multiple choice / true/false questions
  - randomized
- Grading scheme: short answer & sketch questions
- short answer: much better to type, avoid handwriting if at all possible

**Midterm scope**
- scope: emphasis on foundations material
- 75 points (to help you budget your time, 1 pt ~= 1 minute)
- Analyze these existing visualizations by breaking down into marks and channels
- Critique suitability of this existing visual encoding for abstract task+data combination
-包括 scalability assessment for items, links, 1 level within an attribute
- Propose appropriate visual encoding for task+data combination
- and provide rationale to justify your design choices versus key alternatives

**Subtopics**
- Interactive Views
- Selection and highlighting strategies
- Interaction
- Types of multiple views: multi-form, overview/detailed same encoding, overview/zoom/multi-form, zoom multiple
- Strengths and weaknesses of juxtapose vs superimpose
- Impact of partitioning strategies
- Color
  - channel characteristics for hue, saturation, value
  - sequential vs diverging for quantitative attributes
  - variation vs brightness
  - color deficiency nature of problem and strategies to address it

**Items & Attributes**
- item: individual entity, discrete
  - eg patient, car, stock, city
- “Independent variable”
  - attributes: property that is measured, observed, logged...
  - eg height, blood pressure for patient
  - “Dependent variable”
  - eg horsepower, make for car

**Attributes types**
- which classes of values & measurements?
  - categorical (nominal)
    - compare equality
    - no implicit ordering
    - unordered
    - ordinal
    - least/greatest than defined
    - meaningful magnitudes
    - arithmetically possible
  - quantitative

**Data abstraction: Three operations**
- translate from domain-specific language to generic visualization language
- identify dataset(s), attribute types
- identify cardinality
  - how many items in the dataset?
  - what is cardinality of each attribute?
  - number of levels for categorical data
  - range for quantitative data
  - consider whether to transform data
    - guided by understanding of task
Analyze
Produce
Consume
Discover
tag
Compare
Present
Locate
Lookup
Actions
Link marks: Connection and containment
• marks as links (vs. nodes)
– common case in network drawing
– 1D case:
– Lines Areas
Containment Connection
Marks As Items/nodes
Marks As Links
Points Lines Areas
Containment Connection
Embed: Focus+Context
• combine information
within single view
• elide
– selectively filter and aggregate
– superimpose layer
– local lens
– distortion design choices
– region shape: radial, rectilinear, complex
– how many regions: one, many
– region extents: local, global
– intersection metaphor

How to handle complexity: 4 families of strategies

Three kinds of network visual encodings

Node-link vs. matrix comparison

Distortion costs and benefits

• benefits
  – combine focus and context
  – information in single view
• costs
  – length comparison impaired
  – network/tree topology
  – comparison unfeasible
  – connection, containment
  – effects of distortion unclear if original structure unfamiliar
  – object constancy/tracking
  – maps impaired

Tree drawing idioms comparison

• data shown
  – link relationships
  – tree depth
  – sibling order
• design choices
  – connection vs containment
  – link marks
  – rectilinear vs radial layout
  – spatial position channels
  – considerations
    – redundant? arbitrary?
    – information density?
• visual design space
  – consider where to fit labels!

Rules of Thumb Summary

• No unjustified 3D
  – Power of the plane
  – Disparity of depth
  – Occlusion hides information
  – Perspective distortion dangers
  – Tilted text isn’t legible
• No unjustified 2D
  – Eyeball memory
  – Resolution over immersion
• Overview first, zoom and filter, details on demand
• Responsiveness is required
• Function first, form next

Link marks: Connection and containment

• marks as links (vs. nodes)
  – common case in network drawing
  – 1D case:
    – ac all node-link diagrams
    – emphasizes topology, path tracing
    – networks and trees
  – 2D case containment
    – ac all containment variants
    – emphasizes attribute values at leaves (size coding)
  – only trees

Node-Link Diagrams

Tree Depth

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Node-link vs. matrix comparison

• node-link diagram strengths
  – topology understanding, path tracing
  – intuitive, flexible, no training needed
• adjacency matrix strengths
  – focus on edges rather than nodes
  – layout straightforward (rendering needed)
  – predictability, scalability
  – some topology tasks trainable
• empirical study
  – node-link best for small networks
  – matrix best for large networks
  – if tasks don’t involve path tracing!


http://www.michaelmcguffin.com/courses/vis/patternsInAdjacencyMatrix.png