Computer Science Principles: Review Guide for CS390/590

Under each Big Idea there is a list of things we did in the CS390/590 course that pertain to that Big Idea. Then you will see a list of things to review associated with each Big Idea.

Big Idea I: Creativity.
used computing tools and techniques to create computational models
analyzed computational artifacts (in our case, models)
used computing tools and techniques for creative expression

What to review
Review your programming homework assignments.
Review the Computer Science Principles Learning Objectives
Review the Supercomputing Challenge's project rubric.
Review the computational science cycle.

Big Idea II: Abstraction.
described the combination of abstractions used to represent data.
explained how binary sequences are used to represent digital data.
develop several abstractions.
described and used of multiple levels of abstraction in agent-based models
used models and simulations to raise and answer questions.

What to review
Review the videos on Abstraction, Automation and Analysis
Review the videos on Data Compression especially as it pertains to graphics and videos.
Review your final project's use of abstraction.

Big Idea III: Data.
used computers to process information to gain insight and knowledge.
used computing to facilitate exploration and the discovery of connections in information.
used datasets to explore and discover information and knowledge.

What to review:
Review how models can be used to generate data.
Review how the data generated by running models can be processed and used to gain insight and knowledge.
Review how we designed experiments to aid in knowledge discovery.
Review how we conducted parameter sweeps to facilitate exploration and discovery.

Big Idea IV: Algorithms.
developed an algorithm. (for example, for hill climbing)
expressed an algorithm in a language.

appropriately connected problems and potential algorithmic solutions.
demonstrated how to evaluated algorithms analytically and empirically.

What to review:
What is an algorithm?
How to walk through an algorithm with an input and determine what the output will be. (trace)
How to determine which of two algorithms might be better.   What dimensions should be considered?

Big Idea V: Programming.
explained and demonstrated how to implement algorithms.
used abstraction to manage complexity in programs.
evaluated a program for correctness.
developed a correct program.
employed appropriate mathematical and logical concepts in programming.

What to review:
Decomposing a problem into components
Loops
Conditionals
Evaluation of expressions
Variables
Tracing through programs
Use of the Random function to simulate rolling dice
Program logic

Big Idea VI: Internet.
explained the abstractions in the Internet and how the Internet functions.
explained characteristics of the Internet as a complex system.
connected the concern of cybersecurity with the Internet and systems built on it.

What to review:
Characteristics of Complex systems.
TCP IP protocols (Appendix A of Blown to Bits)
Privacy and security issues

Big Idea VII: Impact.
analyzed how computing affects communication, interaction, and cognition.
connected computing with innovations in other fields.
analyzed the beneficial and harmful effects of computing.
connected computing within economic, social, and cultural contexts.

What to review:
Explain how computing (modeling and simulation in particular) is both powerful and can be connected to one's passions.

The guest presenters, how is modeling and simulation used to impact other fields?
Blown to bits – beneficial and harmful effects of computing
Group discussion on making modeling and simulation relevant to students.