The final is comprehensive, and you will be responsible for knowing everything on the midterm study guide as well as all of the material outlined here.

**ROR Analysis (see Cash Flow Analysis Handout)**
- Net Present Value (NPV)
  - What is it?
  - What is the formula for it?
    - as a function of interest rate $i$.
    - or as a function of discount factor $\delta$
- Rate of Return
  - What is it?
  - How do you compute it?

**Messerschmitt Ch 5 – Client-Server Computing**
- Client-Server Architecture
- Peer to Peer Architecture
- Three-Tier Client Server Architecture
- Thin Clients

**Messerschmitt Ch 6 -- Modularity and Layering**
- Modularity
- Granularity
- Hierarchy
- Interfaces – actions, parameters, and returns
- The Layering Principle
  - Layers of computing Infrastructure
    - Applications, Components, Middleware, Operating System, Networks
  - Spanning Layer
  - Data and Information in Layers
- Abstraction and Encapsulation

**Messerschmitt Ch 7 -- Computer and Communications Industries**
- Infrastructure and Applications
- Decomposition and Assembly (also covered in Ch 10)
- Components and Custom Development
- Interoperability
- Outsourcing
- System Integration
- Products and Services
- Stovepipe and Integrated Infrastructure
- Vertical Integration and Diversification
• Computing/Communications Convergence
  • Standardization
    o Why are they needed?
    o Why do companies participate?
    o Reference Models and Interfaces
    o De Facto and De Jure Standards
    o Standards Bodies
    o Open Standards

Messerschmitt Ch 15 -- Data Sharing
• DBMS
  o Capabilities—manage storage and processing and retrieval of information from one or more databases; maintain data integrity; access control
• Relational Database
  o Record, Field, Database Operations
• SQL
• Markup Languages
  o XML vs. HTML
  o Uses?

Messerschmitt Ch 9 -- Applications and the Organization
• Application Lifecycle Model of Development
  o Conceptualization
  o Analysis
  o Architecture
  o Development Evolution
  o Testing
  o Deployment
  o Operations, Maintenance, and Upgrade
• Buy vs. Make vs. Outsource

Messerschmitt Ch 10 -- Application Architecture
• Object Oriented Programming (OOP)
• Object -- attributes, behavior
  o Method
  o Interface
  o Class
• Software Reuse – Why is it important? How does OOP help?
• Software Components
• Component Assembly tools – what do they do?
  o Visual vs. Scripting
• Software Frameworks – what do they do? examples?

Messerschmitt Ch 18 & Lecture Slides
(some of the material I covered in the slides is not in the book.)

- Layering of Network Architecture
- Physical Layer
- Link Layer
  - Ethernet
  - Ethernet Medium Access Control Protocol
  - Hubs and Switches
  - MAC Addresses
- Network Layer
  - Routing Table
  - Packet Forwarding
  - IP Addresses
- IP Addresses vs. MAC Addresses
- Encapsulation of IP packets within an Ethernet Frame
- 7 OSI Layers
- Time Division Multiplexing
- Statistical Multiplexing
- Congestion Control vs. Flow Control
- Transport Protocols – TCP and UDP
- ISP, NSP, Local Loop, Telephone Company Local Office
- Web Caching

**Case Studies**

**Sun Case**

- Why is the total cost of ownership (TCO) of a Windows PC much higher than the purchase price?
- What is a thin-client? Why might it have the potential to reduce the TCO?
- What are the drawbacks of having thin-client vs. a traditional fat-client?
- What selfish reasons does Sun have for advocating a thin-client model? Why does Microsoft prefer maintaining the dominance of the fat-client model?
- What is Java, and what advantages does it have over other languages?
- Since the case was written, which operating system has come to dominate the web-server market?

**MySQL**

- What are the different segments of the database market? Which segment is MySQL strongest in? Which segment is the largest portion of the database market?
- Who are the three biggest suppliers of database management systems? What competitive advantages over the major DBMS suppliers does MySQL have in the Web Site data segment of the market?
Why would large enterprises prefer to manage their mission-critical, enterprise-wide data with database software from one of the three major DBMS providers, rather than using MySQL’s product which is much cheaper?

What is a General Public License (GPL)? Why were MySQL’s customers willing to pay for the product, when they could get the product for free under a GPL?

**Akamai**

- Where are the bottlenecks in the Internet according to the case study?
- What is a Content Distribution Network (CDN)? What does it provide over ordinary web Caching?
- Where did Akamai locate its servers? What barriers to entry existed for a new entrant to build a CDN to compete with Akamai?
- Did Akamai choose to market its products with a direct sales force or through distribution partners? What are the advantages of each choice?
- Why did Akamai’s marketing strategy have to change when they transitioned from the Free Flow product to the Edge Suite product.

**American Airlines**

- What do flight dispatchers do, and what information do they need to make their decisions? How did the dispatch automation package assist the flight dispatchers?
- What stages of development did the flight dispatch automation package go through?
- What were some of the benefits of good architecture and Object Oriented Programming in the context of the flight dispatch automation package?
- How did the flight dispatch automation package interact with AA’s legacy systems?