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?
- Infinite Series
  - What is the NPV of an infinite series of receipts?

**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
  - Why are they needed?
  - Why do companies participate?
Messerschmitt Ch 11 -- Programming an Application
- Algorithms and Protocols
- Names and Hierarchical Names
- Addresses and References

Messerschmitt Ch 15 -- Data Sharing
- DBMS
  - Capabilities—Structured data model, persistence, Transaction support, access control, encapsulation, and scalability
- Relational Database
  - Record, Field, Database Operations
- SQL
- Object relational Databases (ORDBMS)
- Transaction Processing
  - Purpose?
  - Resource Managers, Abort, Rollback, Commit
- Markup Languages
  - XML vs. HTML
  - Uses?

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

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

Software Frameworks – what do they do? examples?

Messerschmitt Ch 16 -- Middleware

Middleware

- What is it?
- Message Oriented Middleware
  - Message Queue
- Mobile Code, Mobile Object, Mobile Agent
- Portability vs. Interoperability
- Java Virtual Machine
- Distributed Object Management
  - Client Object
  - Server Object
  - Distributed Object Management Middleware
  - CORBA

Messerschmitt Ch 18&19 – Issues in Networks

(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
- 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

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?

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 do load planners do? What factors must they consider when making a load plan?
• What are some of the factors that complicate crew scheduling?
• Why do airlines change their fares so frequently?

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?

IT Doesn’t Matter
• What does Nicholas Carr mean when he says that companies should manage IT as a “commodity input?”
• What counter arguments can be made against Carr’s thesis?