Courses

COMP 1000/1003 PERSONAL COMPUTER APPLICATIONS (2) LEC. 2. Introduction to personal computers and software applications, including word processing, spreadsheets, databases, and presentation graphics; generation and retrieval of information with the Internet; integration of data among applications.

COMP 1200 INTRODUCTION TO COMPUTING FOR ENGINEERS AND SCIENTISTS (2) LEC. 2. Computer programming in a high-level language, with emphasis on use of the computer as a tool for engineering or science.

COMP 1201 INTRODUCTION TO COMPUTING LABORATORY (1) LAB. 1. SU. Coreq. COMP 1200. Laboratory activities focused on computer programming in a high-level language.

COMP 1210 FUNDAMENTALS OF COMPUTING I (3) LEC. 2. LAB. 3. Introduction to the fundamental concepts of programming from an object-oriented perspective. Emphasis on good software engineering principles and development of the fundamental programming skills in the context of a language that supports the object-oriented paradigm.

COMP 1AA0 COMPUTER COMPETENCY TEST (0) TST. SU. A comprehensive test of all material covered in COMP 1000 and COMP 1003.

COMP 2000 NETWORK PROGRAMMING WITH HTML AND JAVA (3) LEC. 3. Pr. COMP 1000 or COMP 1003 or ENGR 1110 or ENGR 1113. Introduction to network programming using HTML and Java to build web pages and web-based applications; presentation graphics; retrieval of information from the Internet; integration of data among applications. Pr., COMP 1000 or higher, or ENGR 1110.

COMP 2210 FUNDAMENTALS OF COMPUTING II (4) LEC. 3. LAB. 3. Pr. COMP 1210 or COMP 1217. Software development in the context of collections (e.g., lists, trees, graphs, hashtables). Communication, teamwork, and a design experience are integral course experience.

COMP 2710 SOFTWARE CONSTRUCTION (3) LEC. 3. Pr. COMP 2210. Intensive experience in software construction, to include topics such as testing, debugging, and associated tools; configuration management; low-level file and device I/O; systems and event-driven programming.

COMP 3000 OBJECT-ORIENTED PROGRAMMING FOR ENGINEERS AND SCIENTISTS (3) LEC. 3. Pr., Departmental approval. Fundamentals of object-oriented design and programming principles; data abstraction, identifying objects, problem decomposition, design and implementation of classes. Credit for the major will not be given to CSCI and SWEN, and WIRS majors.

COMP 3010/3013 SPREADSHEET-BASED APPLICATIONS WITH VISUAL BASIC (3) LEC. 2. LAB. 3. Pr. A grade of D or higher in COMP 1200-3000. COMP 1200 or higher. Design and implementation of applications such as simulations, spreadsheet front-ends for modeling, interfaces to databases, and multimedia applications.

COMP 3220 PRINCIPLES OF PROGRAMMING LANGUAGES (3) LEC. 3. Pr. COMP 2210. Study of programming language principles supporting procedural abstraction, data abstraction, storage allocation, and parallel execution; language types and examples; language translations.

COMP 3240 DISCRETE STRUCTURES (3) LEC. 3. Pr. COMP 1210 or COMP 1217. Characterization of computer science data structures and algorithms in terms of sets and relations, functions, recurrence relations. Use of propositional and predicate calculus to describe algorithms. Proving correctness and running time bounds for algorithms by induction and structural induction.

COMP 3270 INTRODUCTION TO ALGORITHMS (3) LEC. 3. Pr. COMP 3240 and COMP 2210. Algorithms for standard computational problems and techniques for analyzing their efficiency; designing efficient algorithms and experimentally evaluating their performance.

COMP 3350 COMPUTER ORGANIZATION AND ASSEMBLY LANGUAGE PROGRAMMING (3) LEC. 3. Pr. ELEC 2200 or ELEC 2210. Stored Program Computers, hardware and software components; data representation, instruction sets, addressing modes; assembly language programming; linkers, loader, and operating systems.

COMP 3500 INTRODUCTION TO OPERATING SYSTEMS (3) LEC. 3. Pr. COMP 2710 and (COMP 3350 or ELEC 2220). Structure and functions of operating systems; processes and process scheduling; synchronization and mutual exclusion; memory management; auxiliary storage management; resource allocation and deadlock; security, privacy, and ethical concerns; design tradeoffs.
COMP 3510 EMBEDDED SYSTEMS DEVELOPMENT (3) LEC. 3. Pr. COMP 2710 and (COMP 3350 or ELEC 2220). Operating system design and analysis for embedded systems: Real-time issues, resource management, scheduling, exception handling, device driver development, kernel development, synchronization, network support.

COMP 3700 SOFTWARE MODELING AND DESIGN (3) LEC. 3. Pr. COMP 2710. Current processes, methods, and tools related to modeling and designing software systems. Communication, teamwork, and a design experience are integral course experiences.

COMP 3710 WIRELESS SOFTWARE ENGINEERING (3) LEC. 3. Pr. COMP 2710. Software engineering for wireless applications: specification, process, testing, and performance evaluation. Design and development of wireless application layer software, including current protocols.

COMP 4200 FORMAL LANGUAGES (3) LEC. 3. Pr. COMP 3240. Fundamentals of formal languages including mathematical models of regular sets, context-free languages and Turing machines; deterministic and non-deterministic models.

COMP 4300 COMPUTER ARCHITECTURE (3) LEC. 3. Pr. COMP 3350. Comparison of computer architectures, emphasizing the relationships between system software and hardware. Includes processor control and datapath organization, memory subsystem design, instruction set design, processor simulation, and quantitative analysis of computer performance.

COMP 4320 INTRODUCTION TO COMPUTER NETWORKS (3) LEC. 3. Pr. COMP 3500 or COMP 3510 or Departmental approval. Fundamentals of computer networks, OSI model, LAN, WAN, packet transmission, interworking, Internet Protocol, WWW and Java technology.

COMP 4710 SENIOR DESIGN PROJECT (3) LEC. 3. Pr. COMP 3700 or COMP 3710. Development of requirement definitions, architectural design specification, detailed design specification, testing plan and documentation for the software and/or hardware components of a comprehensive project.

COMP 4730 COMPUTER ETHICS (1) LEC. 1. Pr. (PHIL 1020 or PHIL 1023 or PHIL 1027) or PHIL 1040. Application of ethical principles to computing-related topics, including privacy, property rights, autonomy, access, and diversity. Communication and teamwork are integral course experiences.

COMP 4960 SPECIAL PROBLEMS (1-4) IND. Course may be repeated for a maximum of 6 credit hours.

COMP 4970 SPECIAL TOPICS (1-3) LEC. 1-3. Investigation of current topics in computer science and software engineering. Departmental approval Course may be repeated for a maximum of 12 credit hours.

COMP 4997 HONORS THESIS (3-6) IND. Pr. Honors College. Departmental approval. Individual student endeavor consisting of directed research and writing of honors thesis. Course may be repeated for a maximum of 6 credit hours.

COMP 5000 WEB APPLICATION DEVELOPMENT (3) LEC. 3. Departmental approval. Design and implementation of web sites and associated applications. Emphasis on user interface design and information organization and presentation. Fall, Spring.

COMP 5020 ADVANCED WEB APPLICATION DEVELOPMENT (3) LEC. 3. Pr. COMP 5000. Departmental approval. Design and implementation of interactive web applications in Java as applets and servlets. Use of concepts like security, internationalization, multi-threading and server/client architectures.

COMP 5120 DATABASE SYSTEMS I (3) LEC. 3. Pr. COMP 3270. Theoretical and applied issues related to the analysis, design, and implementation of relational database systems.

COMP 5130 DATA MINING (3) LEC. 3. Pr. COMP 3270. Advanced concepts, techniques, and applications of data mining with an algorithmic and computational focus, including data visualization, data warehousing, data cube computation, pattern and rule mining, classification, belief networks, clustering, outlier detection, graph matching, and parallel and distributed computation.

COMP 5200 THEORETICAL COMPUTER SCIENCE (3) LEC. 3. Pr. COMP 4200. Departmental approval. The nature of the recursive sets and recursively enumerable sets. Decidability. Context-sensitive grammars and linear-bounded automata, including closure properties; oracles; reduction; the arithmetic hierarchy; the analytic hierarchy.

COMP 5210 COMPILER CONSTRUCTION (3) LEC. 3. Pr. COMP 4200 and COMP 3220. Compiler organization; lexical analysis; parsing; syntax- direction translation; symbol tables; basic dependence analysis; intermediate forms; interpreters vs. compilers; run-time storage management; code generation; error detection and recovery.

COMP 5330 PARALLEL AND DISTRIBUTED COMPUTING (3) LEC. 3. Pr. COMP 3500 or COMP 3510. Overview of hardware and software issues in parallel systems: fundamental parallel architectures, programming languages, tools and algorithms, parallel applications.

COMP 5340 NETWORK QUALITY ASSURANCE AND SIMULATION (3) LEC. 3. Pr. COMP 4320 or ELEC 5220. Theoretical and practical aspects of network simulation and quality assurance.

COMP 5350 DIGITAL FORENSICS (3) LEC. 3. Pr. COMP 2710 or ISMN 3080 or (MNGT 3080 or MNGT 3087). Departmental approval. Computer compromise and forensics, with focus on computer crime and ways to uncover, protect, and exploit digital evidence.

COMP 5360 WIRELESS AND MOBILE NETWORKS (3) LEC. 3. Pr. COMP 4320. Departmental approval. Mobile IP, wireless routing, location management, ad-hoc wireless networks, wireless TCP personal communication systems, and GSM.


COMP 5400 FUNDAMENTALS OF COMPUTER GRAPHICS (3) LEC. 3. Pr. COMP 2710 and MATH 2660. Graphics hardware and software components, coordinate systems, 2-D and 3-D transformations, 3-D viewing and projection, clipping and windowing, scan conversion and algorithms, visibility determination and shadowing, and software projects using a graphics software package.

COMP 5500 DISTRIBUTED OPERATING SYSTEMS (3) LEC. 3. Pr. COMP 4320. Basic concepts of distributed systems. Concurrent process communication and synchronization mechanisms, distributed process scheduling, distributed file systems, distributed shared memory, distributed system security and case studies.

COMP 5520 NETWORK AND OPERATING SYSTEM ADMINISTRATION (3) LEC. 3. Pr. COMP 4320. Studies of the installation, configuration and management of traditional, distributed and networked system software. Network integration of different systems. Performance monitoring, safety and security issues together with policies, politics and the laws regarding system software management.


COMP 5630 MACHINE LEARNING (3) LEC. 3. Pr. COMP 3270. An exploration of current concepts, techniques, and applications in machine learning including abductive learning, case-based learning, deep learning, and reinforcement learning.

COMP 5700 SOFTWARE PROCESS (3) LEC. 3. Pr. COMP 3700 or COMP 3710. Departmental approval. Process models of the software life cycle as well as methods and tools for software development.

COMP 5710 SOFTWARE QUALITY ASSURANCE (3) LEC. 3. Pr. COMP 3700 or COMP 3710. Departmental approval. Processes, methods, and tools associated with the production of robust, high-quality software.

COMP 5720 REAL TIME AND EMBEDDED SYSTEMS (3) LEC. 3. Pr. COMP 3500 or COMP 3510. Concepts of real-time and embedded computer systems. Studies of real-time algorithm issues such as timeliness, time-constrained scheduling and communication. Embedded system issues such as limited memory, low power, and high latency communication. Fall, Spring.

COMP 5970 SPECIAL TOPICS (1-3) LEC. Departmental approval. Investigation of current topics in computer science and software engineering. Course may be repeated for a maximum of 9 credit hours.

COMP 6000/6006 WEB APPLICATION DEVELOPMENT (3) LEC. 3. Departmental approval. Design and implementation of web sites and associated applications. Emphasis on user interface design and information organization and presentation. Fall, Spring.
COMP 6020/6026 ADVANCED WEB APPLICATION DEVELOPMENT (3) LEC. 3. Pr. COMP 6000 or COMP 6006. Departmental approval. Design and implementation of interactive web applications in Java as applets and servlets. Use of concepts like security, internationalization, multi-threading and server/client architectures. Fall, Spring.

COMP 6120/6126 DATABASE SYSTEMS I (3) LEC. 3. Departmental approval. Theoretical and applied issues related to the analysis, design, and implementation of relational database systems.

COMP 6130/6136 DATA MINING (3) LEC. 3. Advanced concepts, techniques, and applications of data mining with an algorithmic and computational focus, including data visualization, data warehousing, data cube computation, pattern and rule mining, classification, belief networks, clustering, outlier detection, graph matching, and parallel and distributed computation.

COMP 6200/6206 THEORETICAL COMPUTER SCIENCE (3) LEC. 3. Departmental approval. The nature of the recursive sets and recursively enumerable sets. Decidability. Context-sensitive grammars, and linearounded automata, including closure properties; oracles; reduction; the arithmetic hierarchy; the analytic hierarchy.

COMP 6210/6216 COMPILER CONSTRUCTION (3) LEC. 3. Departmental approval. Compiler organization; lexical analysis; parsing; syntax- direction translation; symbol tables; basic dependence analysis; intermediate forms; interpreters vs. compilers; run-time storage management; code generation; error detection and recovery.

COMP 6320/6326 DESIGN AND ANALYSIS OF COMPUTER NETWORKS (3) LEC. 3. Departmental approval. Computer networks design, including multiplexing, switching, routing, internetworking, transport protocols, congestion control, and performance evaluation.

COMP 6330/6336 PARALLEL AND DISTRIBUTED COMPUTING (3) LEC. 3. Departmental approval. Overview of hardware and software issues in parallel systems: fundamental parallel architectures, programming languages, tools and algorithms, parallel applications.

COMP 6340/6346 NETWORK QUALITY ASSURANCE AND SIMULATION (3) LEC. 3. Departmental approval. Theoretical and practical aspects of network simulation and quality assurance.

COMP 6350/6356 DIGITAL FORENSICS (3) LEC. 3. Pr. COMP 2710 or ISMN 3080 or (MNGT 3080 or MNGT 3087). Departmental approval. Computer compromise and forensics, with focus on computer crime and ways to uncover, protect, and exploit digital evidence.

COMP 6360/6366 WIRELESS AND MOBILE NETWORKS (3) LEC. 3. Departmental approval. Mobile IP, wireless routing, location management, ad-hoc wireless networks, wireless TCP personal communication systems, and GSM.


COMP 6400/6406 FUNDAMENTALS OF COMPUTER GRAPHICS (3) LEC. 3. Departmental approval. Graphics hardware and software components, coordinate systems, 2-D and 3-D transformations, 3-D viewing and projection, clipping and windowing, scan conversion and algorithms, visibility determination and shadowing, and software projects using a graphics software package.

COMP 6500/6506 DISTRIBUTED OPERATING SYSTEMS (3) LEC. 3. Departmental approval. Basic concepts of distributed systems. Concurrent process communication and synchronization mechanisms, distributed process scheduling, distributed file systems, distributed shared memory, distributed system security and case studies.

COMP 6520/6526 NETWORK AND OPERATING SYSTEM ADMINISTRATION (3) LEC. 3. Departmental approval. Studies of the installation, configuration and management of traditional, distributed and networked system software. Network integration of different systems. Performance monitoring, safety and security issues together with policies, politics and the laws regarding system software management.

COMP 6600/6606 ARTIFICIAL INTELLIGENCE (3) LEC. 3. Departmental approval. Introduction to intelligent agents, search knowledge representation and reasoning, machine learning.

COMP 6610/6616 ARTIFICIAL INTELLIGENCE PROGRAMMING (3) LEC. 3. Pr. COMP 6600 or COMP 6606. Departmental approval. Design and implementation of advanced artificial intelligence techniques including expert systems, planning, logic and constraint programming, knowledge representation and heuristic search methods.
COMP 6620/6626 USER INTERFACE DESIGN AND EVALUATION (3) LEC. 3. Departmental approval. Theory and practice of designing interfaces for interactive systems, usability engineering techniques; implementing and evaluating interfaces.

COMP 6630/6636 MACHINE LEARNING (3) LEC. 3. An exploration of current concepts, techniques, and applications in machine learning including abductive learning, case-based learning, deep learning, and reinforcement learning.

COMP 6700/6706 SOFTWARE PROCESS (3) LEC. 3. Departmental approval. Process models of the software life cycle as well as methods and tools for software development.

COMP 6710/6716 SOFTWARE QUALITY ASSURANCE (3) LEC. 3. Departmental approval. Processes, methods, and tools associated with the production of robust, high-quality software.

COMP 6720/6726 REAL TIME AND EMBEDDED SYSTEMS (3) LEC. 3. Departmental approval. Concepts of real-time and embedded computer systems. Studies of real-time algorithm issues such as timeliness, time-constrained scheduling and communication. Embedded system issues such as limited memory, low power, and high latency communication. Fall, Spring.

COMP 6970/6976 SPECIAL TOPICS (1-3) LEC. Investigation of current topics in computer science and software engineering. Course may be repeated for a maximum of 9 credit hours.

COMP 7120/7126 DATABASE SYSTEMS II (3) LEC. 3. Pr. COMP 6120 or COMP 6126. Departmental approval. Theoretical and applied issues related to the analysis, design, and implementation of object-oriented database systems.


COMP 7270/7276 ADVANCED TOPICS IN ALGORITHMS (3) LEC. 3. Departmental approval. In-depth study of advanced topics in algorithms.

COMP 7300/7306 ADVANCED COMPUTER ARCHITECTURE (3) LEC. 3. Departmental approval. Modern instruction level parallel computer design, including superscalar and very-long instruction word processor design.

COMP 7320/7326 ADVANCED COMPUTER NETWORKS (3) LEC. 3. Pr. COMP 6320 or COMP 6326. Departmental approval. Advanced network topics, including ISDN, ATM, active networks, security, Internet, wireless and mobile networks, and network management.

COMP 7330/7336 TOPICS IN PARALLEL AND DISTRIBUTED COMPUTING (3) LEC. 3. Pr. COMP 6330 or COMP 6336. Departmental approval. Parallel programming languages, environments and tools, parallel algorithms performance issues, distributed memory systems, group communication, fault tolerance.

COMP 7360/7366 WIRELESS AND MOBILE NETWORKS (3) LEC. 3. Pr. COMP 6360 or COMP 6366. Departmental approval. Mobile IP, wireless routing, location management, ad-hoc wireless networks, wireless TCP, personal communication systems, and GSM.

COMP 7370/7376 ADVANCED COMPUTER AND NETWORK SECURITY (3) LEC. 3. Pr. COMP 6370 or COMP 6376. Departmental approval. Advanced, research-based examination of computer network attack and defense techniques, viruses and other malware; operating system vulnerabilities and safeguards.

COMP 7400/7406 ADVANCED COMPUTER GRAPHICS (3) LEC. 3. Pr. COMP 6400 or COMP 6406. Departmental approval. Advanced 3-D topics including visual realism issues, visible surface determination algorithms, illumination and shading models, surface and solid modeling, advanced modeling techniques, special purpose graphics architectures, and animation. Software projects will be assigned.

COMP 7440 SIMULATION OF COMPUTER NETWORKS (3) LEC. 3. Departmental approval. Research-based examination of network simulation, including TCP/IP networks, wireless networks and verification and validation of a network simulation.

COMP 7500/7506 ADVANCED TOPICS IN OPERATING SYSTEMS (3) LEC. 3. Departmental approval. Advanced topics in operating system concepts, design and implementation.
COMP 7600/7606 COMPUTATIONAL INTELLIGENCE (3) LEC. 3. Pr. COMP 6600 or COMP 6606. Departmental approval. A study of computational intelligence with emphasis on the design and implementation of neural, genetic and fuzzy computing techniques.

COMP 7610/7616 COMPUTATIONAL COGNITION (3) LEC. 3. Pr. COMP 6600 or COMP 6606. Departmental approval. Computational models of cognition, including knowledge representations and process mechanisms like means-ends analysis, semantic networks, frames.

COMP 7620/7626 HUMAN-COMPUTER INTERACTION (3) LEC. 3. Departmental approval. Coreq. COMP 6620. Theoretical principles and practical aspects of interaction between humans and computers, design and evaluation of interactive systems.

COMP 7700/7706 SOFTWARE ARCHITECTURE (3) LEC. 3. Pr. (COMP 6700 or COMP 6706) and (COMP 6710 or COMP 6716). Departmental approval. Methods and tools related to the analysis, specification and design of software architecture.

COMP 7710/7716 SOFTWARE ENVIRONMENTS (3) LEC. 3. Pr. (COMP 6700 or COMP 6706) and (COMP 6710 or COMP 6716). Departmental approval. Issues associated with the design, implementation, and use of software engineering environments.

COMP 7720/7726 SOFTWARE RE-ENGINEERING (3) LEC. 3. Pr. (COMP 6700 or COMP 6706) and (COMP 6710 or COMP 6716). Departmental approval. Process, methods and tools associated with re-engineering software systems.

COMP 7730/7736 FORMAL METHODS FOR SOFTWARE (3) LEC. 3. Pr. (COMP 6700 or COMP 6706) and (COMP 6710 or COMP 6716). Departmental approval. Precise, abstract models for characterizing and reasoning about properties of software systems.

COMP 7740 AGENT-DIRECTED SIMULATION (3) LEC. 3. Pr. COMP 6700 or COMP 6706. Departmental approval. Covers entire simulation software development life cycle including problem formulation, system and objectives definition, conceptual modeling, model design, implementation, analysis of simulation data, and credibility assessment including verification and validation. Special emphasis is given to modeling aspects using agent-directed simulation methodology.

COMP 7930/7936 DIRECTED STUDY (1-3) IND. Course may be repeated with change in topics.

COMP 7950/7956 INTRODUCTION TO GRADUATE STUDY IN COMPUTER SCIENCE AND SOFTWARE ENGINEERING (1) LEC. 1. SU. Introduction to graduate research and study topics in computer science and software engineering.

COMP 7970/7976 SPECIAL TOPICS (1-3) LEC. Course may be repeated with change in topics.

COMP 7980/7986 CAPSTONE ENGINEERING PROJECT (3) LEC. 3. Planning, implementation, and completion of a design project. Project culminates in both a written report and an oral presentation.

COMP 7990/7996 RESEARCH AND THESIS (1-15) MST. May count either COMP 7990 or COMP 7996. Course may be repeated with change in topics.

COMP 8120 CURRENT TOPICS IN DATABASE SYSTEMS (3) LEC. 3. Pr. COMP 6120 or COMP 6126. Departmental approval. Theoretical and applied research issues related to database systems. Topics will reflect current research in the field.

COMP 8220 RESEARCH TOPICS IN PROGRAMMING LANGUAGES (3) LEC. 3. Pr. COMP 7220 or COMP 7226. Departmental approval. Topics of current research in the area of programming languages, their design, and implementation.


COMP 8330 ADVANCED TOPICS IN PARALLEL AND DISTRIBUTED COMPUTING (3) LEC. 3. Pr. COMP 6330 or COMP 6336. Parallelizing compiler, theory of concurrency, advanced parallel algorithms, load balancing, migration, performance evaluation, distributed architectures. Departmental approval.

COMP 8400 CURRENT TOPICS IN COMPUTER GRAPHICS (3) LEC. 3. Pr. COMP 7400 or COMP 7406. Departmental approval. In-depth study of current research topics in computer graphics. Topics may include theoretical, performance implementation, and system integration issues. Extensive literature survey, issue identification, performance comparison, and future research trends will be discussed.

COMP 8500 RESEARCH TOPICS IN OPERATING SYSTEMS (3) LEC. 3. Pr. COMP 7500 or COMP 7506. Departmental approval. Topics of current research in the area of operating systems their design, and implementation.
COMP 8600 ADVANCED TOPICS IN ARTIFICIAL INTELLIGENCE (3) LEC. 3. Pr. COMP 6610 or COMP 6616 or COMP 7600 or COMP 7606 or COMP 7610 or COMP 7616. Departmental approval. In-depth study of current research topics in Artificial Intelligence, e.g., reasoning mechanisms, heuristic search methods, cognitive modeling.

COMP 8620 ADVANCED TOPICS IN HUMAN-COMPUTER INTERACTION (3) LEC. 3. Pr. COMP 7620 or COMP 7626. Departmental approval. In-depth study of current research topics in Human- Computer Interaction, e.g., evaluation and assessment methods, multimodal interfaces, educational technology.

COMP 8700/8706 CURRENT TOPICS IN SOFTWARE ENGINEERING (3) LEC. 3. Pr. (COMP 6700 or COMP 6706) and (COMP 6710 or COMP 6716). Departmental approval. Current theoretical and applied research issues in software engineering.

COMP 8930/8936 DIRECTED STUDY (1-3) IND. Course may be repeated for a maximum of 6 credit hours.

COMP 8970 SPECIAL TOPICS (1-3) IND. Course may be repeated with change in topics.

COMP 8990/8996 RESEARCH AND DISSERTATION (1-15) DSR. Course may be repeated with change in topics.