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**Information Technology Code Book (Based on IEEE IT Undergraduate Curriculum Framework 2008)**

Knowledge Area	Overview of Knowledge Area	Knowledge Units	Examples
<b>IT Fundamentals (ITF)</b>	This knowledge area is intended to be at the introductory level in a curriculum and to provide foundation skills for subsequent courses. It provides an overview of the discipline of IT, describes how it relates to other computing disciplines, and begins to instill an IT mindset.	<p>ITF. Pervasive Themes in IT</p> <p>ITF. History of Information Technology</p> <p>ITF. IT and Its Related and Informing Disciplines</p> <p>ITF. Application Domains</p>	<ol style="list-style-type: none"> <li>1. Explain how the components of an IT system interrelate.</li> <li>2. Explain how and why complexity occurs in IT.</li> <li>3. Explain why life-long learning and continued professional development is critical for an IT professional.</li> <li>4. Illustrate the use of information and communication technologies to solve problems as an IT professional.</li> <li>5. Manage complexity in an information technology environment by applying best practices and using appropriate technologies and methodologies.</li> <li>6. Describe the role of the IT professional as the user advocate.</li> <li>7. Explain why adaptability and interpersonal skills are important to an IT professional.</li> <li>8. Explain the difference between a concept and the possible representations of that Concept: for example, the relationship between information and data.</li> </ol> <ol style="list-style-type: none"> <li>1. Outline the history of computing technology, the Internet, and the World-Wide Web.</li> <li>2. Explain how computing and society impact one another.</li> </ol> <ol style="list-style-type: none"> <li>1. Explain the relationship between IT and related and informing disciplines.</li> <li>2. Design, create and implement an information system that serves multiple audiences</li> </ol> <ol style="list-style-type: none"> <li>1. Explain how and to what extent IT has changed various application domains.</li> <li>2. Explain how IT has impacted the globalization of world economy, culture, political systems, health, security, warfare etc.</li> </ol>
<b>Human Computer Interaction (HCI)</b>	Human-computer interaction (HCI) involves the study, planning, design and uses of the interaction between people (users) and computers. It is often regarded as the intersection of computer science, behavioral sciences, design, media studies, and several other fields of study.	HCI. Human Factors	<ol style="list-style-type: none"> <li>1. Describe the relationship between the cognitive principles and their application to interfaces and products.</li> <li>2. Explain the conceptual terms for analyzing human interaction with products such as affordance, conceptual model, and feedback.</li> <li>3. Explain the importance of user abilities and characteristics in the usability of products.</li> <li>4. Analyze different user populations with regard to their abilities and characteristics for using both software and hardware products.</li> <li>5. Illustrate how cognitive principles are applied to product design.</li> </ol>

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<p><b>Human Computer Interaction (HCI)</b></p>	<p>Graduates have to develop knowledge of HCI, including but not limited to such areas as user and task analysis, human factors, ergonomics, accessibility standards, and cognitive psychology.</p>	<p>HCI. HCI Aspects of Application Domains</p>	<ol style="list-style-type: none"> <li>6. Design a product for a specific user population.</li> <li>7. Show how the physical aspects of product design impact its usability.</li> <li>8. Distinguish between the various principles for designing for humans.             <ol style="list-style-type: none"> <li>1. Explain the connection between the design of a user interface and a model of user domain expertise.</li> <li>2. Describe several affordances of a Web environment that can enhance the usability of a Web-based application.</li> <li>3. Describe different types of interactive environments.</li> <li>4. Describe the differences in developing user interfaces for different application environments (e.g., Web pages, standalone applications, etc.)</li> <li>5. Match descriptions of cognitive models with the model names.</li> <li>6. Advanced learning outcomes:</li> <li>7. Develop user interfaces for domain specific applications.</li> <li>8. Integrate domain experts' knowledge into specific requirements for domain-specific user interfaces.</li> </ol> </li> </ol>
	<p>HCI. Human-Centered Evaluation</p>	<ol style="list-style-type: none"> <li>1. List the general principles used in the heuristic evaluation of a user interface design.</li> <li>2. Evaluate visualization systems</li> <li>3. Critically evaluate the information architecture and design of websites using a user-centered approach.</li> <li>4. Perform a simple usability evaluation for an existing software application.</li> <li>5. Classify usability performance and preference metrics: learning, task time, task completion, and user satisfaction.</li> <li>6. Describe common usability guidelines and standards.</li> <li>7. Create an appropriate usability test plan.</li> <li>8. Measure the usability of a product by analyzing the data from the performance and preference metrics.</li> </ol>	
	<p>HCI. Developing Effective Interfaces</p>	<ol style="list-style-type: none"> <li>1. Define the critical issues and theoretical underpinnings of User Experience (UX) design</li> <li>2. Select an appropriate UI Interaction style for a task.</li> <li>3. Using a prototyping tool, develop a high-fidelity prototype of a GUI which incorporates feedback from early usability testing.</li> <li>4. Explain how the UI and usability affect one another.</li> <li>5. Define the different types of interaction styles.</li> <li>6. List examples of localization and globalization that would impact design.</li> </ol>	

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		HCI. Accessibility	<ol style="list-style-type: none"> <li>7. Describe ways in which users' characteristics (i.e., age, education, cultural differences, etc.) require adaptation of a user interface to increase effectiveness.</li> <li>8. Describe techniques for developing prototypes of user interfaces.</li> </ol> <ol style="list-style-type: none"> <li>1. Critique different visualization techniques as applied to particular tasks</li> <li>2. List some of the impacts of at least one guideline or standard on designing computer-based applications.</li> <li>3. Identify sources of accessibility guidelines and standards.</li> <li>4. List some of the advantages and disadvantages of biometric access control.</li> <li>5. Describe the symptoms of repetitive stress syndrome and list some of the approaches that can ameliorate the problem.</li> <li>6. Demonstrate the use of accessibility features, such as a narrator.</li> <li>7. Choose a biometric access system for a given application and include the criteria used for making the choice.</li> </ol>
		HCI. Emerging Technologies	<ol style="list-style-type: none"> <li>1. Apply information visualization concepts and techniques in the design of new, innovative visualizations</li> <li>2. List several of the emerging alternative I/O devices.</li> <li>3. Modern trends and topics in mobile application development</li> <li>4. Describe the difference between mobile computing and wearable computing.</li> <li>5. Describe and give examples of pervasive computing.</li> <li>6. Modify the design of an application to be used on a mobile device.</li> <li>7. Describe the ideal characteristics of a wearable display and compare these to what can be done with current technology.</li> <li>8. List the desirable and undesirable characteristics of a virtual reality system.</li> </ol>
		HCI. Human-Centered Computing	<ol style="list-style-type: none"> <li>1. Establish requirements for UX design concepts using techniques such as persona development, task description, and use cases</li> <li>2. Demonstrate knowledge of the basic concepts and terminology of website development and administration and user-centered design</li> <li>3. Explain the characteristics of human-centered design methods.</li> <li>4. List the advantages and disadvantages for using a human-centered software development approach.</li> <li>5. Identify a situation in which a user need can be addressed by a software product.</li> <li>6. Describe, in scenario form, a problem situation to be addressed by a new or redesigned</li> </ol>



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<p><b>Information Assurance and Security (IAS)</b></p>		<p>(Countermeasures)</p>	<ol style="list-style-type: none"> <li>3. Use a PKI-based application to demonstrate how public-key cryptography works.</li> <li>4. Explain the three key factors involved in authentication and how they are used to verify identity and grant access to a system.</li> <li>5. Explain the characteristics of an effective password to end-users.</li> <li>6. Describe and compare physical access control to logical access control.</li> <li>7. Identify the key types of biometric information utilized in authentication from the perspectives of accuracy, intrusiveness and efficiency.</li> <li>8. Explain the differences between symmetric and asymmetric cryptosystems, e.g., number of keys required, the types of algorithms used, etc.</li> <li>9. Explain how cryptosystems offer integrity, confidentiality and authentication.</li> <li>10. Explain digital signatures and certificates.</li> <li>11. Explain how public key infrastructure (PKI) works.</li> </ol>
		<p>IAS. Security Mechanisms (Countermeasures)</p>	<ol style="list-style-type: none"> <li>12. Describe the single sign-on authentication process and problems related to using and implementing this technology.</li> <li>13. Compare and contrast key access control and authentication mechanisms to select the one appropriate to specific business contexts (Kerberos, RAS, etc.).</li> <li>14. Compare the advantages and disadvantages of centralized access controls to decentralized access controls.</li> <li>15. Describe the DES and 3DES algorithms.</li> <li>16. Describe the AES algorithm.</li> <li>17. Explain the differences between block and stream cryptosystems.</li> <li>18. Explain the differences in efficiency and performance between software based and hardware based cryptosystems.</li> </ol>
	<p>IAS. Operational Issues</p>	<ol style="list-style-type: none"> <li>1. Describe legal and ethical considerations related to the handling and management of enterprise information assets.</li> <li>2. Identify the types of company assets to be protected by a security plan.</li> <li>3. Articulate and communicate legal and ethical aspects of corporate security practices</li> <li>4. Specify what constitutes admissible evidence in a legal proceeding and how to acquire and maintain this information.</li> <li>5. Describe the importance of and key elements involved in incident tracking to develop an incident handling and reporting process.</li> <li>6. Identify risks associated with disasters or disruptions and specify key mitigation strategies.</li> <li>7. Specify the key aspects of physical site security.</li> </ol>	

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		<p style="text-align: center;">IAS. Operational Issues</p>	<ol style="list-style-type: none"> <li>8. Describe the elements contributing to the cost of an organization’s security management and operations process and their relation to risks and losses associated with information assurance or security related issues and incidents.</li> <li>9. Describe and evaluate employment policies and practices that are relevant to safeguarding an organization's information assets.</li> <li>10. Describe the importance of utilizing standards and key standard processes currently utilized in information assurance and their areas of relevance (i.e. DES – Data Encryption Standard).</li> <li>11. Describe the purpose and elements of the key types of security audits. Discuss how various security standards (i.e. ISO 177799) impact the direction of these audits.</li> <li>12. Develop an incident handling and reporting process.</li> <li>13. Recommend appropriate operational and managerial processes to mitigate security and information assurance issues based on a Business Impact Analysis (BIA) report.</li> <li>14. Create a BIA report that itemizes costs associated with information assurance and security activities and compares these costs to potential risks and costs associated with incidents in these areas.</li> <li>15. Explain how key information security and assurance standards are or should be utilized in specific industry contexts.</li> <li>16. Discuss the role of CASPR (Commonly Accepted Security Practices and Recommendations) forms in defining and approving standard operational and management practices.</li> <li>17. Evaluate how changes in technology and the constantly changing threats impact operational and managerial practices and policies.</li> </ol>
		<p style="text-align: center;">IAS. Policy</p>	<ol style="list-style-type: none"> <li>1. Explain how an organization might develop a policy to defend against password vulnerabilities</li> <li>2. Explain why security policies must consider all aspects of an organization in order to be effective.</li> <li>3. Describe the role of policy and procedure in the IAS Model.</li> <li>4. Explain why policy and procedure are listed as countermeasures.</li> <li>5. Explain how poorly defined and executed policies can be a vulnerability.</li> <li>6. Explain why a password policy might need to be modified due to changing circumstances.</li> <li>7. Give an example of how vulnerability in one area of an organization might enable a compromise in another area. (Example: weak physical security allows sniffer access to the LAN which allows a password to be read from a POP3 packet. The password is used to gain access to a corporate server. Login access to the server allows a root-kit to be applied and the bad guy has total access to the server).</li> <li>8. Describe a situation in which an incident would require a full forensic approach</li> </ol>







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		<p>IAS. Security Services</p>	<ol style="list-style-type: none"> <li>1. Define and explain the four basic types of information security attacks the five principles of information security</li> <li>2. Explain the role of integrity, confidentiality, availability, authentication, and non-repudiation as security services</li> <li>3. Explain how cryptographic encryption algorithms are used to implement confidentiality in document transfer</li> <li>4. Describe the possible availability levels for a web service.</li> <li>5. Explain how redundancy and geographic dispersion relate to availability.</li> <li>6. Explain how one-way cryptographic functions are used to implement integrity in document transfer.</li> <li>7. Explain how one-way functions and encryption are used to implement a typical authentication service.</li> <li>8. Explain how one-way functions are used to implement a non-repudiation service.</li> <li>9. Describe the sequence of events for a typical Challenge Handshake Authentication Protocol (CHAP) authentication scheme.</li> <li>10. Describe the sequence of events needed to protect the integrity and ensure non-repudiation of an electronic contract distributed through email to the participants in the contract.</li> <li>11. Describe what needs to be done in addition to provide confidentiality for the contract in 2 above.</li> </ol>
		<p>IAS. Threat Analysis Model</p>	<ol style="list-style-type: none"> <li>1. Demonstrate knowledge of the concepts and terminology of information security management and risk assessment</li> <li>2. Describe the costs associated with actions that can be taken to mitigate security risks</li> <li>3. Identify the aspects of a business that may be impacted by a security breach or interruption of operation.</li> <li>4. Quantify the financial losses associated with potential security breaches and interruption of operations.</li> <li>5. Identify and describe the nine steps to assess risks associated with security specified by the National Institute of Standards and Technology (NIST).</li> <li>6. Perform a comprehensive risk assessment for a specified organization.</li> <li>7. Create an Information Risk Management (IRM) policy for an organization by analyzing its information assets to determine the appropriate financial, managerial and security aspects of this policy.</li> </ol>

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		IAS. Vulnerabilities	<ol style="list-style-type: none"> <li>8. Identify the quantitative and qualitative measures that can be used to assess risk and evaluate the effectiveness of risk management policies and practices.</li> <li>9. Specify the value of the benefits to be achieved as a result of risk mitigation efforts and relate this benefit to the cost associated with achieving these benefits.</li> <li>10. Justify appropriate mitigation strategies by comparing the costs associated with a specific risk and the mitigation strategy.</li>   <li>1. Describe the role of the user in information assurance and how they fit into an overall information assurance plan for an organization</li> <li>2. List and explain the typical threats and vulnerabilities for an organization’s network</li> <li>3. Define white hat, black hat, hacker and cracker.</li> <li>4. Explain how culture, community, tools, and technologies contribute to compromising systems.</li> <li>5. Explain to a non-security community of users what measures they must follow and why, in a situation where their jobs are not security-related.</li> <li>6. Give an example of how inside and external attacks are similar and are different.</li> <li>7. Demonstrate how you would test a system for vulnerabilities.</li> <li>8. Perform a vulnerability analysis of a system.</li> <li>9. Develop user education modules to educate users on their role in information assurance.</li> <li>10. Choose a common vulnerability and describe how an attacker uses this vulnerability to gain access to a system.</li> <li>11. Contrast how various technologies are used by hackers and crackers.</li> <li>12. Compare and contrast various attack methodologies and differentiate between internal and external attacks.</li> <li>13. Demonstrate how software contributes to the vulnerabilities of an organization.</li> <li>14. Explain how design, implementation, and installation of software contribute to the vulnerabilities of an organization.</li> <li>15. Demonstrate how hardware contributes to the vulnerabilities of an organization.</li> <li>16. Explain how design, implementation, and installation of hardware contribute to the vulnerabilities of an organization.</li> </ol>
<b>Information Management (IM)</b>	Information derived from data is important to the management, productivity and differentiation of an organization. Data must be efficiently collected, organized, retrieved and managed to make it meaningful to the organization. It is the role of an IT professional to	IM. Information Management Concepts and Fundamentals	<ol style="list-style-type: none"> <li>1. Information retrieval and management skills</li> <li>2. Explain the operation of Database Management Systems</li> <li>3. Explain the role of data, information, and databases in organizations</li> <li>4. Differentiate and use key terms such as: information, data, database, database management system, metadata, and data mining.</li> <li>5. Explain how data storage and retrieval has changed over time.</li> <li>6. Explain the advantages of a database approach compared to traditional file processing.</li> <li>7. Identify and explain the general types of databases: personal, workgroup, department,</li> </ol>



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		<p>IM. Data Organization Architecture</p>	<p>TRIGGERS.</p> <ol style="list-style-type: none"> <li>16. Analyze and declaratively define appropriate referential integrity constraints and</li> <li>17. DELETE/INSERT/UPDATE options SET NULL, SET DEFAULT, CASCADE, and RESTRICT (NO ACTION).</li> <li>18. Analyze, select and declare physical storage/file structures and options using advanced SQL data definition and related options.</li> <li>19. Analyze the need for and use report generators and advanced SQL reporting operators.</li> <li>20. Use statistical optimization and tuning options for evaluating and improving performances of SQL queries including materialized views.</li> </ol> <ol style="list-style-type: none"> <li>1. Explain database environments and development processes</li> <li>2. Describe the features of the relational model including relations, tuples, attributes, domains and operators</li> <li>3. Give examples of user defined integrity constraints</li> <li>4. Describe and interpret Entity Relationship diagrams.</li> <li>5. Create a simple Entity Relationship diagram.</li> <li>6. Describe and interpret Enhanced Entity Relationship diagrams.</li> <li>7. Select appropriate business rules for a given scenario.</li> <li>8. Describe the relationship between a logical model and a physical model.</li> <li>9. Select a pattern or standard model that effectively corresponds to a given scenario.</li> <li>10. Explain the use of CASE tools in data modeling.</li> <li>11. Describe data integration.</li> <li>12. Describe meta-modeling.</li> <li>13. Describe a data warehouse, its basic structure, etc.</li> <li>14. Create and design Entity Relationship diagrams.</li> <li>15. Create and design Enhanced Entity Relationship diagrams.</li> <li>16. Formulate and explain identification of business rules.</li> <li>17. Create and evaluate a logical model.</li> <li>18. Create and evaluate a physical model.</li> <li>19. Use a given CASE tool.</li> <li>20. Demonstrate how to reengineer databases.</li> <li>21. Apply a pattern or standard model to develop a solution for a given scenario.</li> <li>22. Create and evaluate meta-models.</li> <li>23. Explain the concept of data integration and its use in the creation of data warehouses and data marts.</li> <li>24. Change an existing data warehouse.</li> <li>25. Change an existing data mart.</li> </ol>
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		<p>IM. Special Purpose Databases</p>	<ol style="list-style-type: none"> <li>14. Describe the concept of web services and the role of SOAP.</li> <li>15. Perform the basic functions of a data administrator, including database planning, analysis, design, implementation, maintenance and protection.</li> <li>16. Explain different concurrency control protocols.</li> <li>17. Given a security protocol, secure a database.</li> <li>18. Given a backup protocol, backup a database.</li> <li>19. Recover a database.</li> <li>20. Analyze the appropriateness of a recommendation to replicate (or not replicate) a distributed database in a given situation.</li> <li>21. Analyze the appropriateness of a partitioning recommendation for a distributed database in a given situation.</li> <li>22. Use XML in the implementation of an n-tier database architecture.</li> <li>23. Connect a number of different databases and/or other applications using SOAP.</li> </ol> <ol style="list-style-type: none"> <li>1. Demonstrate an understanding of online analytical processing and data warehouse systems</li> <li>2. Describe methods of data mining and what insights may be gained by these methods</li> <li>3. Demonstrate an understanding of the role and the concepts involved in special purpose databases such as Full-text, Multimedia, Temporal, Spatial, Mobile, Scientific (e.g. genomic) and other similar database types and effectively use some of them.</li> <li>4. Declare, integrate and retrieve and analyze data from on-line analytic processing systems and data warehouses using SQL extensions ROLLUP, CUBE, and RANK.</li> <li>5. Use data mining visualization and heuristic options in discovery and decision support processes.</li> <li>6. Demonstrate an understanding of knowledge management.</li> <li>7. Examine a given Digital Library and comment on how well-structured and/or user friendly it is.</li> </ol>
<p><b>Integrative Programming and Technologies (IPT)</b></p>	<p>Organizations typically use many disparate technologies that need to communicate and work with each other. A key component to the discipline of Information Technology is the integration of applications and systems. This knowledge area examines the various types of programming</p>	<p>IPT. Intersystems Communications</p>	<ol style="list-style-type: none"> <li>1. Describe and contrast the different types of architectures for integrating systems</li> <li>2. Define the role of DCOM, CORBA, and RMI in distributed processing</li> <li>3. Describe the role of socket programming in communicating between systems and contrast the protocols and uses of TCP/IP sockets and Datagram sockets</li> <li>4. Describe how web services are used to integrate disparate applications in an organization: for example, describe the role of the WSDL, SOAP, and UDDI architectures in creating and using web services.</li> <li>5. Describe the purpose of message and queuing services and how they work and list the protocol used by one messaging service (e.g. JMS).</li> </ol>











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<p><b>Networking (NET)</b></p>	<p>telecommunications, inter/intranetworking, and infrastructure security. It also includes application of networking to multimedia, information storage and distribution, and the World Wide Web.</p>	<p>NET. Routing and Switching</p>	<ol style="list-style-type: none"> <li>5. Explain the basic components and media of network systems and distinguish between LANs and WANs.</li> <li>6. Explain how bandwidth and latency impact throughput in a data communications channel.</li> <li>7. Deploy a basic Ethernet LAN and compare it to other network topologies.</li> <li>8. Configure a client and a server operating system and connect the client machine to the server over a LAN.</li> <li>9. Analyze and compare the characteristics of various communication protocols and how they support application requirements.</li> <li>10. Demonstrate the ability to solve basic problems and perform basic troubleshooting operations on LANs and connected devices.</li> </ol> <ol style="list-style-type: none"> <li>1. Describe the necessary hardware (switches and routers) and components (routing algorithms and protocols) used to establish communication between multiple networks</li> <li>2. Explain the operation and function of 802.1 devices and protocols</li> <li>3. Summarize and describe the data communications and telecommunications models, topologies, protocols, standards and architectures in use today.</li> <li>4. Discuss the concepts and the “building blocks” of today’s data communication networks such as switches, routers, and cabling.</li> <li>5. Describe the necessary hardware (switches and routers) and components (routing algorithms and protocols) used to establish communication between multiple networks.</li> <li>6. Analyze the effect of various topologies, applications and devices on network performance topics such as latency, jitter, response time, window size, connection loss and quality of service.</li> <li>7. Construct multiple networks and connect them together.</li> <li>8. Analyze and explain routing algorithms and protocols, process routing tables and configure routers for proper operation.</li> <li>9. Compare and contrast routing protocols and compare/contrast the functions and operation of interior routing protocols with exterior routing protocols.</li> <li>10. Explain VLANs, trunking and port aggregation and configure and deploy switches utilizing the above.</li> <li>11. Illustrate how load balancing is accomplished in routers and switches and deploy and test devices utilizing load balancing.</li> <li>12. Describe strategies to ensure the availability of network access in switched and routed networks.</li> <li>13. Select appropriate routing and switching equipment for a given network application.</li> </ol> <ol style="list-style-type: none"> <li>1. Compare and contrast methods of error detection and correction such as parity, CRC, and EDC</li> </ol>
		<p>NET. Physical Layer</p>	

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		<p style="text-align: center;">NET. Security</p>	<ol style="list-style-type: none"> <li>2. Critically compare the bandwidth characteristics of several types of physical communication media</li> <li>3. Explain how the three variables of Shannon’s law impact channel capacity.</li> <li>4. Compare and contrast the historical evolution of the switched and routed infrastructures.</li> <li>5. Analyze the physical challenges inherent in wireless-fixed and wireless-mobile communication channels.</li> <li>6. Describe how most modern communication standards are developed, addressing both de jure and defacto standards.</li> <li>7. Choose the appropriate compression methodology (lossy or lossless) for a given type of application.</li> <li>8. Analyze and compare four networking topologies in terms of robustness, expandability, and throughput.</li> <li>9. Compare and contrast the advantages and disadvantages of satellite communication.</li> <li>10. Calculate the link budget for a given satellite link.</li> <li>11. Choose a given criterion for rating communication links and order the following from best to worst:wired over unshielded twisted pair; wired over coax; wireless over microwave; wired over optical fiber; wired over shielded twisted pair; wireless over RF (&lt; 1GHz); satellite link.</li> <li>12. Select appropriate physical media for a given network application.</li> <li>13. Demonstrate the operation of a phase-locked loop (PLL), and describe how it is used in digital communication.</li> </ol> <ol style="list-style-type: none"> <li>1. Explain how SSL protects confidentiality of a TCP connection</li> <li>2. Demonstrate knowledge of the tools and techniques needed to secure the Web communication systems including E-mail FTP VPNs</li> <li>3. Explain how secret-key algorithms protect data confidentiality during transport over a network.</li> <li>4. Explain how public-key algorithms work to authenticate and how they negotiate secret keys.</li> <li>5. Explain how a remote access and a point-to-point VPN work.</li> <li>6. Explain how firewalls mitigate some network attack scenarios.</li> <li>7. Explain why weak passwords are a significant problem in networks.</li> <li>8. Describe a scenario where an intrusion detection system (IDS) could detect a password cracking attempt and what action an intrusion prevention system (IPS) could use to defend against it.</li> </ol>
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		<p>NET. Network Management</p>	<ol style="list-style-type: none"> <li>9. Install and configure a firewall.</li> <li>10. Demonstrate that a firewall is properly configured using a vulnerability testing tool.</li> <li>11. Install and configure an intrusion detection system (IDS).</li> <li>12. Demonstrate the function of an IDS by analyzing a simulated intrusion.</li> <li>13. Demonstrate the function of an IPS by simulating an attack and documenting the results.</li> </ol> <ol style="list-style-type: none"> <li>1. Demonstrate troubleshooting and critical-thinking skills with the tools and techniques needed to secure network-based communication systems</li> <li>2. Discuss typical architectures for network management including the management console, aggregators and device agents</li> <li>3. Demonstrate the management of a device such as an enterprise switch through a management console.</li> <li>4. Compare and contrast various network management techniques as they apply to wired and wireless networks. (This will include topics on devices, users, quality of service, deployment, and configuration of these technologies.)</li> <li>5. Dissect different security tools and describe implementation strategies of these tools to ensure efficient and effective protection for wired and wireless networks.</li> <li>6. Describe the configuration and deployment strategies of network devices to optimize network security.</li> <li>7. Design and implement a local area network.</li> <li>8. Design a wide area network.</li> <li>9. Configure the network nodes (computers, routers, etc).</li> <li>10. Troubleshoot a network problem.</li> <li>11. Develop and implement a backup and disaster recovery plan as it relates to the network components of an organization.</li> <li>12. Develop and implement a security plan as it relates to the network components of an organization.</li> <li>13. Select, install and use appropriate network management tools to collect performance data from a set of network nodes.</li> </ol>
		<p>NET. Application Areas</p>	<ol style="list-style-type: none"> <li>1. Explain the role of networking in database and file service applications</li> <li>2. Analyze the impact on the World-wide Web portion of the Internet if the majority of all routers ceased to function</li> <li>3. Install a streaming media server and demonstrate its use from a client application.</li> <li>4. Explain the implications of multicasting on streaming media delivery.</li> <li>5. Install and demonstrate a voice communication service such as VOIP.</li> <li>6. Compare and contrast some of the characteristics of present multimedia data technologies.</li> </ol>

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			<ol style="list-style-type: none"> <li>1. Proactively monitor and protect the corporate computer network to ensure continuous operation</li> <li>2. Contribute to design, and development of new networking features and feature enhancements for application proxies spanning a wide range of layer 7 protocols and web applications</li> <li>3. Design and deploy company LANs, WANs, and WLANs, including servers, routers, hubs, switches, UPSs and other hardware.</li> <li>4. Ensure network connectivity of all servers, workstations, telephony equipment, fax machines, and other network appliances.</li> <li>5. Develop and deploy methodologies for testing network performance and providing network performance statistics and reports.</li> </ol>
<p><b>Programming Fundamentals (PF)</b></p>	<p>Programming is a foundational skill for all computing disciplines. This knowledge area develops skills and concepts that are essential to good programming practice and problem solving. It covers fundamental programming concepts, event-driven programming, object-oriented programming, basic data structures, and algorithmic processes.</p>	<p>PF. Fundamental Data Structures</p> <p>PF. Fundamental Programming Constructs</p> <p>PF. Object-Oriented Programming</p>	<ol style="list-style-type: none"> <li>1. Write programs that use each of the following data structures: arrays, records, strings, linked lists, stacks, and queues</li> <li>2. Choose the appropriate data structure for modeling a given problem</li> <li>3. Utilize primitive data types and built-in data structures.</li> <li>4. Describe common applications for each data structure in the topic list.</li> <li>5. Describe a simple hash function.</li> <li>6. Modify and expand short programs that use standard conditional and iterative control structures and functions</li> <li>7. Apply the techniques of structured (functional) decomposition to break a program into smaller pieces</li> <li>8. Analyze and explain the behavior of simple programs involving the fundamental programming constructs covered by this unit.</li> <li>9. Design, implement, test, and debug a program that uses each of the following fundamental programming constructs: basic computation, simple I/O, standard conditional and iterative structures, and the definition of functions.</li> <li>10. Choose appropriate conditional and iteration constructs for a given programming task.</li> <li>11. Describe the mechanics of parameter passing and the issues associated with scoping.</li> <li>12. Describe the concept of recursion and give examples of its use.</li> <li>13. Implement and trace the execution stack of a simple recursive function.</li> <li>1. Discuss and identify the concepts of encapsulation, abstraction, inheritance, and polymorphism</li> <li>2. Describe the relationship between an object and its corresponding class</li> <li>3. Compare and contrast the notions of overloading and overriding methods in an object-oriented language</li> <li>4. Design, implement, test, and debug simple programs in an object-oriented programming</li> </ol>

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		<p>PF. Algorithms and Problem-Solving</p> <p>PF. Event-Driven Programming</p>	<p>language.</p> <ol style="list-style-type: none"> <li>5. Describe how the class mechanism supports encapsulation and information hiding.</li> <li>6. Design, implement, and test the implementation of “is-a” relationships among objects using a class hierarchy and inheritance.</li> <li>7. Utilize iterators to access the elements of a container.</li> <li>8. Describe how constructors and destructors relate to the life of an object.</li> <li>9. Describe the relationship between an object and its corresponding class.</li> </ol> <ol style="list-style-type: none"> <li>1. Use a programming language to implement, test, and debug algorithms for solving simple problems</li> <li>2. Discuss the importance of algorithms in the problem-solving process</li> <li>3. Create algorithms for solving simple problems</li> <li>4. Identify the necessary properties of good algorithms.</li> <li>5. Apply effective debugging strategies.</li> </ol> <ol style="list-style-type: none"> <li>1. Explain the difference between event-driven programming and command-line programming</li> <li>2. Develop code that responds to exception conditions raised during execution</li> <li>3. Design, code, test, and debug simple event-driven programs that respond to user events.</li> </ol> <ol style="list-style-type: none"> <li>1. Proficient with C++.</li> <li>2. Application development experience in Java/J2EE technologies.</li> <li>3. Building and enhancing custom solutions using .Net/C#/VB.NET</li> <li>4. Exceptionally strong programming skills in at least one language (C#, Java, C++, Python)</li> <li>5. Knowledge with different programming languages, such as Java, C/C++</li> <li>6. Java/Oracle Programming</li> </ol>
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<p><b>Platform Technologies (PT)</b></p>	<p>IT professionals will encounter a variety of platforms in their careers. The role of the IT professional is to select, deploy, integrate and administer platforms or components to support the organization's IT infrastructure. This knowledge area includes the fundamentals of hardware and software and how they integrate to form essential components of IT systems.</p>	<p>PT. Operating Systems</p>	<ol style="list-style-type: none"> <li>1. Describe the necessary components and functions of an operating system</li> <li>2. Explain the benefits of using scripts to automate operating systems tasks</li> <li>3. Compare at least two operating systems and evaluate their suitability to a given task or goal.</li> <li>4. Install a current operating system and validate that the installation was successful.</li> <li>5. Explain concurrency as it relates to scheduling and dispatching.</li> <li>6. Describe the advantages and issues associated with virtualization.</li> <li>7. Analyze operating system requirements and recommend an appropriate operating system to meet the requirements.</li> <li>8. Install several current operating systems and validate that the installations were successful.</li> <li>9. Write at least one script to perform an operating system task.</li> <li>10. Install a system with at least two virtual machines.</li> <li>11. Compare and contrast the memory management strategies of various popular operating systems.</li> <li>12. Compare and contrast the security models of various popular operating systems.</li> <li>13. Compare and contrast the file systems of various popular operating systems.</li> <li>14. Explain the value of fault tolerance for disaster recovery.</li> <li>15. Explain the implications of virtualization for disaster recovery.</li> </ol>
		<p>PT. Architecture and Organization</p>	<ol style="list-style-type: none"> <li>1. Describe how numbers and characters are represented in a computer</li> <li>2. Describe how a computer stores and retrieves information to/from memory and hard drives</li> <li>3. Define the terms: bus, handshaking, serial, parallel, data rate</li> <li>4. Draw a block diagram, including interconnections, of the main parts of a computer.</li> <li>5. Define the terms: bus, handshaking, serial, parallel, data rate.</li> <li>6. Plan and write a simple assembly-language program.</li> </ol>
		<p>PT. Computing Infrastructures</p>	<ol style="list-style-type: none"> <li>1. Explain the need for power and heat budgets within an IT environment</li> <li>2. Classify and describe the various types of servers and services required within organizations</li> <li>3. Describe the need for hardware and software integration</li> <li>4. Estimate the power requirements for a computer system.</li> <li>5. Prepare a computer system for use as a server.</li> <li>6. Design and implement a multi-computer network and deliver computing services on that network.</li> <li>7. Perform a cost-benefit analysis for a proposed server solution.</li> <li>8. Design a server farm for a given situation.</li> <li>9. Describe three of the major problems associated with current data storage practice.</li> </ol>



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		<p>PT. Enterprise Deployment Software</p> <p>PT. Firmware</p> <p>PT. Hardware</p>	<ol style="list-style-type: none"> <li>1. Enterprise deployment and management software</li> <li>2. Create update management plans and policies</li> <li>3. Prepare and deploy a system image using imaging software</li> <li>4. Identify update management requirements.</li> <li>5. Deploy update management software.</li> </ol> <ol style="list-style-type: none"> <li>1. Describe the benefits of firmware storage options</li> <li>2. Distinguish between firmware, software and hardware</li> <li>3. Describe the need for versioning.</li> </ol> <ol style="list-style-type: none"> <li>1. Virtual machine emulation</li> <li>2. Design a simple finite state machine with at least 6 states and 4 conditional branches, then build and troubleshoot it</li> <li>3. Compare the performance of two different computers with two different operating systems</li> <li>4. Rank the five main hardware implementation options in three different scenarios.</li> </ol>
<p><b>System Administration and Maintenance (SA)</b></p>	<p>Virtually all organizations have IT needs. It is the role of the IT professional to design, select, apply, deploy and manage computing systems to support the organization. This knowledge area consists of those skills and concepts that are essential to the administration of operating systems, networks, software, file systems, file servers, web systems, database systems, and system documentation, policies, and procedures. This also</p>	<p>SA. Operating Systems</p>	<ol style="list-style-type: none"> <li>1. Describe the importance of system maintenance for an organization</li> <li>2. Understand and effectively manage networking services provided by the operating systems including, but not limited to, DNS, DHCP, AD LDAP, network based file and printing, web, email, SNMP, telnet, etc.</li> <li>3. Install at least one current operating system</li> <li>4. Discuss the importance of system configuration for an organization.</li> <li>5. Identify situations in which a system needs to be reconfigured.</li> <li>6. Describe when a system requires maintenance.</li> <li>7. Distinguish between server and client services.</li> <li>8. Identify situations in which a support organization needs to be consulted in resolving operating system issues.</li> <li>9. Evaluate various operating systems and recommend a particular operating system to satisfy given needs.</li> <li>10. Modify the configuration of an operating system.</li> </ol>







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		<p>SIA. Testing and Quality Assurance</p>	<ol style="list-style-type: none"> <li>2. Explain the importance of a cost/benefit analysis to the successful implementation of a project plan</li> <li>3. Discuss the issues involved in creating a project schedule</li> <li>4. Explain the key components of a project plan.</li> <li>5. Explain the importance of a cost/benefit analysis to the successful implementation of a project plan.</li> <li>6. Explain roles and responsibilities for key project personnel and stakeholders.</li> <li>7. Use appropriate project planning and tracking tools.</li> <li>8. Discuss the issues involved in creating a project schedule.</li> <li>9. Explain how to identify the lessons learned in a project closeout and review session.</li> <li>10. Working on a team, prepare a project plan for an IT project that demonstrates an ability to follow standard project management methodology.</li> <li>11. Working on a team, prepare a project plan for an IT project that demonstrates an ability to evaluate project requirements, to define the scope of work, to conduct organizational planning, to identify and evaluate risks, to develop an implementation plan, and to manage change control processes, as well as knowledge of project budgeting, scheduling, and evaluation.</li> <li>12. Assess how well a project follows its project plan.</li> </ol>
		<p>SIA. Organizational Context</p>	<ol style="list-style-type: none"> <li>1. Select the appropriate tools and techniques to create a testing environment</li> <li>2. Explain how an acceptance test is executed and evaluated</li> <li>3. Give examples of current testing standards.</li> <li>4. Explain the various components of usability testing.</li> <li>5. Design a stress test that will test and pinpoint the critical issues that might impact system performance.</li> <li>6. Analyze the results of an acceptance test to determine if the product meets the stated acceptance criteria.</li> <li>7. Summarize and analyze the data from a usability test and recommend appropriate actions.</li> </ol>
		<p>SIA. Architecture</p>	<ol style="list-style-type: none"> <li>1. Discuss the need to take the current IT environment into account in defining a system architecture and in system integration</li> <li>2. Discuss the importance of organizational culture in any system integration project</li> <li>3. Discuss the relationship between business processes and system integration.</li> <li>4. Explain how business processes influence system architecture.</li> <li>5. Explain why business processes may have to change as a result of a system integration project.</li> <li>6. Explain why it is crucial to take organizational culture into account when planning and</li> </ol>

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			<p>executing a system integration project.</p> <ol style="list-style-type: none"> <li>1. Give examples of architectural frameworks and associated best practice models (SOA, Zachman Framework, ITIL, COBIT, ISO 20,000)</li> <li>2. Explain how some specific architectural views relate to the system lifecycle</li> <li>3. Explain “architecture” in the context of system integration and architecture. (IEEE Std. 1471)</li> <li>4. Explain how complex systems can be represented using architectural views and how this facilitates system evolution over time.</li> <li>5. Give examples of modeling tools that support description and management of architectural views.</li> <li>6. Describe the major features of a Customer Resource Management system.</li> <li>7. Describe the major features of an Enterprise Resource Planning system.</li> <li>8. Explain how Enterprise Architecture relates to Information Architecture and how these impact system architecture.</li> <li>9. Explain why the concept of views (viewpoints) is so important to managing information technology in the enterprise.</li> <li>10. Assess how some specific system architecture supports enterprise architecture.</li> <li>11. Give examples of current tools and methodologies for description and evolution of the various architectural views of an enterprise.</li> </ol> <ol style="list-style-type: none"> <li>1. Participates in gathering user/customer functional requirements</li> <li>2. Analyzing of functional requirements and product specifications</li> <li>3. Innovating and improving existing products</li> <li>4. Collaborating with Quality Assurance in developing a test plan to ensure successful deployment of updates</li> <li>5. Configure the application to meet a client's requirements using the Microsoft Dynamics CRM Customization Tool, Workflow Took, or SDK</li> <li>6. Experience in implementation, customization, integration of IBM WebSphere Commerce sites.</li> <li>7.</li> </ol>
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<p>Web Systems &amp; Technologies (WS)</p>	<p>IT applications are increasingly web-based. Web technology has grown to include a variety of business, academic, organizational and social applications. Diverse multi-cultural and multi-lingual user communities now depend on Web technology. This knowledge area covers the design, implementation and testing of web-based applications including related software, databases, interfaces and digital media. It also covers social, ethical and security issues arising from the Web and social software.</p>	<p>WS. Web Technologies</p>	<ol style="list-style-type: none"> <li>1. Describe the importance of the HTTP protocol in Web applications</li> <li>2. Discuss Web standards and standards bodies including the World Wide Web Consortium (W3C)</li> <li>3. Use some presentation technologies, such as Cascading Style Sheets and DHTML</li> <li>4. Describe the structure of the World Wide Web as interconnected hypertext documents.</li> <li>5. Create and validate HTML/XHTML documents.</li> <li>6. Demonstrate an understanding of XML syntax and show how to display such documents in Web applications.</li> <li>7. Discuss and contrast data entry and validation techniques in client-side vs. server-side programming.</li> <li>8. Discuss and contrast client-side with server-side security issues.</li> <li>9. Describe the use of server-side backend databases in web sites and web applications.</li> <li>10. Describe technologies used in web services, including open source languages and packages, proprietary languages and packages, and enterprise Web development and distributed Web applications.</li> <li>11. Compare and contrast open source and proprietary server software.</li> <li>12. Discuss Web Standards in terms of specifications, guidelines, software, and tools.</li> <li>13. Apply and integrate HTML/XHTML/XML syntax to create and validate documents.</li> <li>14. Apply and integrate HTML/XHTML/XML syntax to generate contents via programming.</li> <li>15. Apply and integrate XML syntax to transform documents between formats.</li> <li>16. Apply presentation technologies to author websites, such as Cascading Style Sheets, XSLT-FO, DHTML, etc.</li> <li>17. Evaluate the compliance of web documents with published criteria.</li> <li>18. Use specialized Web Markup languages, such as SVG, SMIL, RSS, etc.</li> <li>19. Construct a website to include Client-side programming with JavaScript, Java Applets, Flash, and other Web GUI technologies.</li> <li>20. Discuss data persistence via cookies in maintaining states.</li> <li>21. Construct Web server programs with Server-side programming using/working with Generic HTTP CGI techniques, Open Source as well as Proprietary languages and packages.</li> <li>22. Discuss issues and implementation of server-side security.</li> <li>23. Discuss issues in maintaining backend databases.</li> <li>24. Design, construct, test and evaluate web services using Open Source languages and packages, proprietary languages and packages and enterprise web development technology.</li> <li>25. Design, construct, test and evaluate distributed web applications.</li> <li>26. Contrast and explain the issues involved in designing web servers including web application servers, streaming media servers, and transformation servers.</li> <li>27. Assess, compare and select emerging and existing Web technologies for solutions, such as XML, SOAP, WSDL, UDDI, Java, C#, EJB, .NET, etc.</li> </ol>
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		<p>5. WS. Social Software</p>	<p>12. Explain how to protect clients from viruses, spyware and zombie processes.  13. Implement client-side and server-side cookies.  14. Identify common server-side configuration issues that affect securing.  15. Implement a security plan to decrease the risks from other users of a shared web server.  16. Design a web application that uses server-side cookies.  17. Describe the mechanism of man-in-the-middle attacks.  18. Explain how DNS Poisoning is used to implement phishing.  19. Explain how to protect clients from becoming zombies.  20. Clean an infected system of viruses and spyware.</p> <p>1. Describe how the Web has given rise to the emergence of online communities  2. Summarize and contrast the characteristics of various web-based communication media, such as Listservs, discussion boards, wikis, blogs, and chat-rooms  3. Describe how the Web has given rise to the emergence of online communities  4. Debate the various ethical issues associated with the Web, including the Digital Divide, issues concerning race and gender, freedom of speech, privacy, copyright and digital content rights.</p> <p>5. Creating Social Media Content for TWR’s FB/Twitter/Instagram  6. Ability to create and upload Twitter &amp; YouTube backgrounds, and minor video editing skills  7. Create feedback and viral loops between our website, Facebook Page and Twitter accounts.</p>
<p>CE-ESY</p>		<p>1. History and overview</p> <p>2. Embedded microcontrollers</p> <p>3. Embedded programs</p>	<p>1. Identify some contributors to embedded systems and relate their achievements to the knowledge area.  2. Describe the meaning of an embedded system.  3. Explain the reasons for the importance of embedded systems.  4. Describe the relationship between programming languages and embedded systems..  5. Describe how computer engineering uses or benefits from embedded systems.</p> <p>1. Understand the CPU in the context of a complete system with I/O and memory.  2. Understand how the CPU talks to the outside world through devices.  3. Understand how memory system design (caches, memory management) affect program design and performance.</p> <p>1. Understand how high-level language programs convert into executable code.  2. Know the capabilities and limits of compilers.  3. Comprehend basic representations of programs used to manipulate programs either in a compiler or by hand.</p>

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CS-AL		4. Real-time operating systems	<ol style="list-style-type: none"> <li>1. Distinguish RTOSs from workstation/server OS.</li> <li>2. Distinguish real-time scheduling from traditional OS scheduling.</li> <li>3. Understand major real-time scheduling policies.</li> <li>4. Understand interprocess communication mechanisms.</li> </ol>
		5. Low-power computing	<ol style="list-style-type: none"> <li>1. Understand why low-power computing is important.</li> <li>2. Identify sources of energy consumption.</li> <li>3. Identify possible remedies for energy consumption at various levels of design abstraction.</li> </ol>
		6. Reliable system design	<ol style="list-style-type: none"> <li>1. Understand the variety of sources of faults in embedded computing systems.</li> <li>2. Identify strategies to find problems.</li> <li>3. Identify strategies to minimize the effects of problems</li> </ol>
		7. Design methodologies	<ol style="list-style-type: none"> <li>1. Understand why real-world projects are not the same as class projects.</li> <li>2. Identify important goals of the methodology.</li> <li>3. Understand the importance of design tracking and documentation.</li> </ol>
		1. Basic Analysis	<ol style="list-style-type: none"> <li>1. Explain what is meant by “best”, “expected”, and “worst” case behavior of an algorithm.</li> <li>2. In the context of specific algorithms, identify the characteristics of data and/or other conditions or assumptions that lead to different behaviors.</li> <li>3. Determine informally the time and space complexity of simple algorithms.</li> <li>4. State the formal definition of big O.</li> <li>5. List and contrast standard complexity classes.</li> <li>6. Perform empirical studies to validate hypotheses about runtime stemming from mathematical analysis.</li> </ol> <p>Run algorithms on input of various sizes and compare performance.</p> <ol style="list-style-type: none"> <li>7. Give examples that illustrate time-space trade-offs of algorithms.</li> </ol>
		2. Algorithmic Strategies	<ol style="list-style-type: none"> <li>1. For each of the strategies (brute-force, greedy, divide-and-conquer, recursive backtracking, and dynamic programming), identify a practical example to which it would apply.</li> <li>2. Use a greedy approach to solve an appropriate problem and determine if the greedy rule</li> </ol>

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		<p>chosen leads to an optimal solution.</p> <ol style="list-style-type: none"> <li>3. Use a divide-and-conquer algorithm to solve an appropriate problem.</li> <li>4. Use recursive backtracking to solve a problem such as navigating a maze.</li> <li>5. Use dynamic programming to solve an appropriate problem.</li> <li>6. Determine an appropriate algorithmic approach to a problem.</li> </ol>
		<p>3. Fundamental Data Structures and Algorithms</p> <ol style="list-style-type: none"> <li>1. Simple numerical algorithms, such as computing the average of a list of numbers, finding the min, max, and mode in a list, approximating the square root of a number, or finding the greatest common divisor</li> <li>2. Sequential and binary search algorithms</li> <li>3. Worst case quadratic sorting algorithms (selection, insertion)</li> <li>4. Worst or average case <math>O(N \log N)</math> sorting algorithms (quicksort, heapsort, mergesort)</li> <li>6. Hash tables, including strategies for avoiding and resolving collisions</li> <li>7. Binary search trees <ul style="list-style-type: none"> <li>o Common operations on binary search trees such as select min, max, insert, delete, iterate over tree</li> </ul> </li> <li>8. Graphs and graph algorithms <ul style="list-style-type: none"> <li>o Representations of graphs (e.g., adjacency list, adjacency matrix)</li> <li>o Depth- and breadth-first traversals</li> </ul> </li> </ol>
		<p>4. Basic Automata, Computability and Complexity</p> <ol style="list-style-type: none"> <li>1. Discuss the concept of finite state machines.</li> <li>2. Design a deterministic finite state machine to accept a specified language.</li> <li>3. Generate a regular expression to represent a specified language.</li> <li>4. Explain why the halting problem has no algorithmic solution.</li> </ol>

GENERAL KNOWLEDGE AREAS

Knowledge Area	Overview of Knowledge Area	Knowledge Units	Examples
Social and	In addition to technical skills, an	SP-COM. Professional	Prepare and deliver an oral presentation for a management audience







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		<p>SP-PS Problem Solving</p> <p>SP-A Accountability</p> <p>SP-CUS Customer Service</p> <p>SP-IS Interpersonal Skills</p> <p>SP-FL Flexibility</p> <p>SP-CT Creative Thinking</p>	<p>generate and evaluate alternatives, and to make recommendations. Ex: Ability to identify and resolve complex network problems; Ability to problem solve and resolve problems creatively; The ability to respond to crises objectively;</p> <p>Ability to work independently with minimum supervision; Ability to work efficiently and effectively in a fast-paced environment, under stress and within time constraints; Stay focused; Ability to manage time and work responsibly without supervision; Ability to manage multiple job tasks at one time; Ability to work independently, self-starter with good time management skills; Ability to work efficiently and effectively in a fast-paced environment, under stress and within time constraints;</p> <p>Works with clients and customers (that is, any individuals who use or receive the services or products that your work unit produces, including the general public, individuals who work in the agency, other agencies, or organizations outside the Government) to assess their needs, provide information or assistance, resolve their problems, or satisfy their expectations; knows about available products and services; is committed to providing quality products and services. EX: Ability to achieve successful outcomes in handling difficult situations and customers; Ability to demonstrate excellent customer service skills; Customer interaction skills; Experience in a customer service environment; General hospitality;</p> <p>Shows understanding, friendliness, courtesy, tact, empathy, concern, and politeness to others; may include effectively dealing with individuals who are difficult, hostile, or distressed; relates well to people from varied backgrounds and different situations; is sensitive to cultural diversity, race, gender, disabilities, and other individual differences. EX: Strong interpersonal skills; Personal Skills; People Skills; Ability to build and maintain relationships with clients, colleagues, and co-workers; Ability to interact professionally with a diverse group;</p> <p>Is open to change and new information; adapts behavior or work methods in response to new information, changing conditions, or unexpected obstacles; effectively deals with ambiguity. Ability to be flexible and resourceful; Ability to work a flexible schedule; Ability to work scheduled and/or unscheduled overtime and callouts; Ability to take on-call duties;</p> <p>Ability to be creative; Support the production of creative deliverables related to digital media, content development</p>
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