Network Specialist Examination

(Level 4)

Syllabus

— Details of Knowledge and Skills Required for

the Information Technology Engineers Examination —

Version 3.1

IPA

INFORMATION-TECHNOLOGY PROMOTION AGENCY, JAPAN

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Major category	Minor category	Outline	Required knowledge	Required skills
1 Requirements Definition of a Network System	1-1 Requirements analysis of an application system	In order to analyze requirements from an application system operating on a network, obtain information from the network users and application developers, which includes performance required by the application, transmitting and receiving sites, data quantity and frequency, data types, and data flow direction of the application.	• Techniques, procedures, and practices for information collection • Definition of goal and scope of the investigation • Technical constraints, and standards and processing of hardware and software • Risk analysis techniques	• Identifying the major information source of user needs • Setting the range and quantity of information to be collected • Analyzing answers from individuals and groups • Selecting and obtaining data related to the task and identifying needs for data • Assembling and summarizing requested information • Analyzing information, and logically framing mutual dependency • Creating detailed materials related to restrictions
	1-2 Analysis of current network system	When adding an application to an existing network, investigate the traffic flowing in the current network system, grasp the operating status, find the issues, and evaluate the impact on other applications. When reconstructing the network infrastructure, investigate the traffic of the existing applications and clarify the current problems and issues.	• Information collection methods • Traffic measurement • Traffic analysis tools • Application system configuration • Network configuration • Application software configuration (middleware configuration)	• Traffic measurement and evaluation • Inferring the bottleneck of a network system from the operating characteristics of the application and the system configuration • Analyzing the system
	1-3 Establishment of work scope	Determine the target application, and establish the work scope. Define the purpose, work scale, goal, and execution period of the design and construction projects of the network system.	• Network connection technologies and operational environment • Availability of resources and project delivery date • Person-hours • Technical constraints	• Creating detailed materials related to work scope • Consolidating requirements suitable for the purpose • Forecasting construction results • Making a plan for demands and constraints of resource • Visually representing the order and concurrency of tasks to be executed • Setting attainment criteria

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	1-4 Definition of network system requirements	Define the design requirements (economic efficiency, performance, conformity to standards) and the operations management requirements (portability, expandability, reliability, security requirements) of the network system. In addition, review the requirements definition documentation with the network users and application developers.	• System capability and system integration • Network connection technologies and operational environment • Network architectures (network hierarchy, protocols, topologies, and addressing architecture, etc.), hardware, and software • Identification of performance requirements • Network security • System lifecycle • Network reliability • Network operations • How to proceed with the review • Domestic and international standards related to networking	• Incorporating information processing requirements of the organization into system requirements • Identifying user expectations • Recognizing conflicting requirements and presenting a solution • Analyzing the correctness and consistency of information • Resolving technical issues • Evaluating the system configuration • Creating detailed materials to support the requirements
2 Design of Network Systems	2-1 Investigation and evaluation of application technologies and products	Investigate and evaluate trends of technologies, products, communication services, vendor information, installation examples, and standardization related to networking. Perform tests in advance if necessary.	• Information collection methods • Network engineering technologies (network hierarchy, protocols, topologies, addressing architecture, traffic, reliability, information security, encoding, data transmission, etc.), hardware, and software • Network application technologies (e-mail, file transfer, web technologies, inter-application communication, content distribution, etc.) • Technical constraints, and standards and processing of hardware and software • Installation test • Domestic and international standards related to networking • Trends in information technology (IoT, big data, AI, etc.)	• Analyzing information, and logically framing mutual dependency • Understanding and evaluating technical information • Creating detailed materials related to restrictions

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	2-2 Design of network systems	Design the network system giving priority to the following matters: (1) Determine the system deployment of the server and clients as well as the network architecture including the protocol and topology, and then evaluate the estimated performance.	• Basic knowledge of network design • Application system configuration • Upper-layer services in the OSI model • Architecture design tools and methodology • Network architectures, hardware, software, and service • Communication methods • Traffic types and load • Throughput • Statistics relating to forecasting traffic load and throughput • Address design • Queuing theory • Remote access and mobile access • High availability design • SDN (Software Defined Networking), NFV (Network Functions Virtualization), network virtualization, etc.	• Separating realistic requirements from technical wishes • Forecasting the results • Analyzing trends in forecasting methodology • Analyzing technical information • Utilizing network engineering technology
		(2) To ensure security, recognize the information security policy and determine the network technologies and security devices used to implement the required security measures.	• System security and potential security holes • Safe network • Confidentiality, alteration prevention, and leakage of information, etc. • Laws related to networking	• Recognizing and implementing the information security policy • Evaluating and modifying security standards • Designing secure networks (authentication, encryption, access control) • Recognizing ethical issues
		(3) As reliability measures, in order to ensure requisite communication in the event of failure of network devices or communication lines as well as failures due to disasters and accidents, determine how to provide backups and recovery of communication lines and network devices. Determine the network management method to ensure efficient management.	• Reliability • Economic efficiency (trade-off between the installation costs and the operational and maintenance costs) • Communication services • Cloud services such as SaaS, PaaS, IaaS, etc. • Network connection technologies and operational environment	• Recognizing the requirement level of application reliability measures • Balancing reliability measures and their costs • Designing networks meeting the requirements

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		(4) Create multiple design scenarios for the network architecture, security measures, and reliability measures. For each scenario, evaluate cost-effectiveness and feasibility.	• Network technology standards and the processing • Application system configuration • Information security • Network technologies and device implementation	• Optimal reuse of existing hardware • Creating flow diagrams, and making use of diagram tools • Forecasting achievement and results • Presenting multiple ideas and information • Evaluating alternative plans, and making a final decision rationally • Applying the standards and procedures of technical documents
	2-3 Planning of business operations on the new network system	Create network system operational procedures for the new network. Also create a business migration plan from the existing network to the new network.	• Business operations • Parties involved and work groups • Change procedures • The organization's issues related to information security	• Identifying needs for information • Analyzing and summarizing information • Making use of project management tools • Maintaining the organization's processes according to the organization's rules • Understanding the user application and associating user needs with the application configuration • Visually analyzing the relationships between processes and procedures as well as part-whole relationships
	2-4 Creation of a work plan	Create a work plan to build the new network system. Create the work plan so that it minimally affects the user's business. The work plan should include recovery if failures should occur during the work. Make the work plan known to the network users, application system developers, and hardware and software vendors. Coordinate with those involved to rectify problems if they exist.	• Integration methodology • How to proceed with the work to implement the system and impact on users • Network connection technologies and operational environment	• Collecting and analyzing information • Interpreting and summarizing results • Analyzing information and the situation, and creating a plan within the business and financial constraints • Planning and coordinating activities • Planning and executing activities • Making use of project management tools and scheduling software • Evaluating the ease and quality of network system implementation • Coordinating with network users, application developers, and hardware/software vendors

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	2-5 Design review	Review the network system design, maintenance and operations plan, and work plan with the network users, application developers, and hardware and software vendors. Clarify the responsibility of each party involved.	• Procedures of the design review, and how to proceed with it • Network architectures, hardware, software, and service • Network connection technologies and operational environment	• Understanding and judging technical information • Evaluating the feasibility of the work plan
3 Construction and Test of the Network System	3-1 Setup	Arrange for the devices, wiring, network software, and communication communication service according to the work plan. Keep the users, vendors, and installation personnel informed about the plans. When a scheduling issue occurs, coordinate with the parties involved and document the results.	• Network configuration • Software installation and configuration procedures • Arrangement of equipment, wiring, network software, and communication service	• Analyzing the situation and information • Considering the risks • Creating alternative plans • Setting action plans • Conforming to proper procedures • Coordinating with parties involved and work groups for problem solving • Documenting the business process flow in detail
	3-2 Installation work	Install, connect, and configure the network devices, wiring, network software, and communication service.	• Software installation and configuration procedures • Data conversion problems and procedures • Compatibility problems and solutions • Hardware configuration • Network architectures, hardware, software, and service	• Building network systems • Using a continuous improvement strategy and its tools • Resolving problems in a timely manner • Creating multiple schedules, setting and managing milestones, and coordinating with the parties involved • Graphically representing and coordinating the impact on productivity
	3-3 Creation of test specifications	Clarify test requirements and scope, and create the test specifications. Prepare the test procedure. Also, create an appropriate test plan.	• Test tools and procedures • Business requirements • Applications • Network environment • Impact on system performance in the event of an error • Network architectures, hardware, software, and service	• Completing system analysis • Analyzing and constructing the system structure • Determining test devices • Associating errors and system functions • Analyzing causes and reasons for problems, and proposing action plans • Analyzing data • Determining the business situation and the appropriateness of the system • Recognizing system strengths and limitations

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	3-4 Execution of test	Execute tests according to the network system test specifications. Repeat the tests until it is determined that the functions and performance of the application are achieved in accordance with requirements.	• Test execution methodology and procedure • Network architectures, hardware, software, and service	• Making use of scheduling tools • Analyzing the test results in detail • Recording the test results • Considering the correct way to proceed with the process • Setting and managing milestones
	3-5 Analysis and evaluation of test results	Document the pass or failure of the test results. In case of a failure, modify the defect, and execute the test again. If there is a problem, propose an improvement to the network system.	• Products and mutual relationship in the test environment • Continuous improvement process for test execution • Reporting procedure in the organization	• Applying rules and principles to processes and data, and deriving a conclusion • Evaluating complicated ideas and information • Considering creative solution techniques, and constructing new plans and approaches • Analyzing and evaluating the test results as an actual issue
4 Operations and Maintenance of Network System	4-1 User support	Set up the network user accounts, and make the network system available to users. Create and execute a training plan for users. Document procedures to ensure information security, and make it known to users. Answer questions from users on system usage.	• Organization's policies and network system operations • Maintenance • Expansion of procedures • Documentation and archiving • Security tools • OS and network system • Network configuration for users	• Applying rules and procedures to documentation and accounts • Describing an overview of maintenance procedures • Identifying and resolving problems • Setting an account and a user's use environment
	4-2 Creation of maintenance and update (upgrade) policies	Create a maintenance policy. In addition, analyze the current network system capability, and then create plans to reconfigure, enhance, and increase appropriate devices taking economic efficiency into account.	• Applications • Network system lifecycle • Network architectures, hardware, software, and service • Mutual dependency between the OS and networking system • Backup procedure	• Identifying user needs and expectations • Forecasting achievement and results • Proposing and executing action plans • Evaluating complicated ideas and information • Evaluating system configuration and stability • Obtaining new product information • Grasping the latest technology trend
	4-3 Creation of a maintenance plan	Create a maintenance plan according to the maintenance policy so that impact on users is kept to a minimum. Also, document maintenance requirements and maintenance procedures, and familiarize network users and application operators with them. If a change is made, notify them of the details of the change immediately.	• Maintenance tools and procedures • Network system operational procedures	• Evaluating the significance of defects • Arranging and documenting information on maintenance • Forecasting technical results • Understanding data, and logically explaining it with logic to the parties involved according to the purpose

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	4-4 Conducting maintenance and update (upgrade)	Conduct maintenance or update (upgrade) according to the maintenance plan. Record the details of maintenance activities.	• Update procedures • Reasons for updating • Data conversion issues and procedures, and compatibility issues and solutions • Network architectures, hardware, software, and service • Maintenance and update procedures • Documentation procedures and standards for maintenance documents	• Executing improvements and modifications in accordance with technological evolution • Evaluating system configuration and stability • Planning an execution process • Understanding system operations and response • Understanding and evaluating received data • Clearly and concisely representing information
	4-5 Backup and data recovery	Create a data backup procedure document for network system devices. Back up data according to the procedure in the maintenance plan. When a problem occurs, recover data efficiently without delay.	• Backup and recovery procedures • Network architectures, hardware, software, and service • Backup media	• Identifying system issues, and evaluating their importance • Documenting information and actions in a detailed support document • Evaluating the effect of actions • Planning and conducting data backup
	4-6 Configuration management of network system	For each of the devices and network software that compose the network system, assign a name (e.g. an ID), and record the configuration data. Update the record when the configuration is changed or updated (upgraded).	• Managing master records as a database, and accessing this database • Organizational procedures for procurement and investment management • Configuration management	• Making use of configuration element management tools • Making use of a master record database • Creating detailed support documents • Monitoring the safe and efficient usage of resources • Monitoring the configuration and efficient usage of the network system
5 Management of Network System	5-1 Monitoring of the network	Determine the targets of performance and security monitoring, abnormality judgment criteria, and monitoring frequency, and execute monitoring. When a network abnormality or security breach is detected through monitoring, report the matter immediately to the network users and application operators.	• How to collect monitoring data • Usage of monitoring tools • OSs • Applications • Network architectures, hardware software, and service • Organization's information security policies and procedures • Documentation, archiving, and security tools	• Analyzing monitoring data • Documenting analysis results accurately and in detail • Understanding trends in performance, and diagnosing performance deviations • Making use of project management tools • Analyzing and evaluating system operations to examine system effectiveness and efficiency

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	5-2 Failure analysis and recovery	To minimize damages from a network failure, identify the faulty portions, analyze the cause, and restore the system within a short time.	• How to analyze monitoring data • OSs • Applications • Network architectures, hardware, software, and service • Network components and equipment management • Troubleshooting procedures	• Taking appropriate measures when an abnormality is found • Interpreting and evaluating data • Troubleshooting system malfunctions and halts • Understanding trends in performance and diagnosing performance deviations
	5-3 Analysis of system performance	Through performance monitoring, analyze system performance according to the performance standards defined in the network system requirements. Perform benchmark tests periodically to check for performance degradation. Review the performance standards in accordance with changes in the network system due to updates (upgrades).	• Network architectures, hardware, software, and service • Traffic status • Response • Benchmark test • System lifecycle	• Utilizing network monitoring and measurement tools • Completing system analysis • Making use of test tools • Analyzing data to evaluate the accuracy of information • Diagnosing performance limitations
	5-4 Analysis and measures against security breaches	Analyze system security by monitoring the network system according to the security standards defined in the network system requirements, and take security measures if there is a problem. Review the security standards in accordance with changes in the network system due to updates (upgrades).	• Network architectures, hardware, software, and service • Security monitoring procedures • Intrusion detection/prevention tools and security diagnosis • Countermeasures to security breaches • Security holes and security patches • Computer viruses	• Taking appropriate responses to security breaches • Utilizing network monitoring, intrusion detection/defense tools, and security diagnostic tools • Utilizing vaccination tools • Collecting information continuously
6 Evaluation of the Network System	6-1 System evaluation	Analyze performance, capability, and security status of the current network system, and then analyze and evaluate the current and potential issues and summarize the results in a report.	• Evaluation, monitoring, and reporting procedures and policies for the network system • Organization's resources and its restrictions • System monitoring process and procedures • Documentation standards and distribution procedures in the organization	• Analyzing and integrating information • Making use of modeling and simulation tools • Evaluating and adjusting action plans • Identifying improvement points • Creating easy-to-understand reports

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	6-2 System improvement proposal	Investigate trends in network technologies and products periodically, analyze the current issues (during the system lifecycle), and then propose appropriate improvement plans for the network system itself as well as its maintenance and operations, considering economic efficiency and expandability.	• Network system lifecycle • Network engineering technology • Network application technology • Traffic forecast • Information collection methods • Technical constraints, and standards and processing of hardware and software	• Proposing modifications and improvements to the system, and analyzing the purpose and constraints • Obtaining new product information • Grasping the latest technology trend • Understanding trends in the network system configurations of other organizations
7 Consulting for Individual Information System Development	7-1 Advice on network system planning and analysis	Provide technical advice on network system planning and analysis in individual information system development from the viewpoint of project staff or consulting.	• Network system lifecycle • Network system evaluation • Network engineering technology • Network application technology	• Understanding trends in the network system configurations of other organizations • Pointing out technical improvement points
	7-2 Advice on network system design, construction, and test	Provide technical advice on network system design, construction, and testing in individual information system development from the viewpoint of project staff or consulting.	• Network system design, construction, and testing • Network architecture, hardware, software, and services • Cloud services such as SaaS, PaaS, IaaS, etc. • Test execution methodology and procedure	• Understanding trends in the network system configurations of other organizations • Pointing out technical improvement points
	7-3 Advice on network system operations and maintenance	Provide technical advice on network system operations and maintenance in individual information system development from the viewpoint of project staff or consulting.	• Network system operations and maintenance • Network service utilization • Network device maintenance	• Understanding trends in the network system configurations of other organizations • Pointing out technical improvement points

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