CAREER PATHWAY DATABASE ADMINISTRATOR (421)

Developed By:

The Interagency Federal Cyber Career Pathways Working Group

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1 421-DATABASE ADMINISTRATOR

1.1 WORK ROLE OVERVIEW

The table below provides an overview of various role-specific elements related to 421-Database Administrator.

Table 1. 421-Database Administrator Work Role Overview

NICE Role Description	*Administers databases and/or data management systems that allow for the secure storage, query, protection, and utilization of data.*
OPM Occupational Series	Personnel performing the 421-Database Administrator work role are most commonly aligned to the following Occupational Series: (Top 5 shown): - 2210 – Information Technology – 68% - 301 – Misc. Administration and Program – 4% - 343 – Management and Program Analysis – 4% - 560 – Budget Analysis – 3% - 550 – Computer Science – 2%
Work Role Pairings	Personnel performing the 421-Database Administrator work role are most commonly paired with the following complimentary Work Roles (Top 5 shown): - 422-Data Analyst – 22% - 451-System Administrator – 18% - 411-Technical Support Specialist – 16% - 431-Knowledge Manager – 7% - 621-Software Developer – 7%
Functional Titles	Personnel performing the 421-Database Administrator work role may unofficially or alternatively be called: - Data Architect - Data Custodian - Data Manager - Data Warehouse Specialist - Database Developer - Database Engineer/Architect - Information Dissemination Manager - Data Security Manager/Specialist - Data Protection Technician/Specialist
Distribution of GS-Levels	Personnel performing the 421-Database Administrator are most commonly found within the following grades on the General Schedule.*

	- ☐ GS-3 – redacted** - ☐ GS-5 – redacted** - ☐ GS-6 – redacted** - ☐ GS-7 – redacted** - ☐ GS-8 – redacted** - ☒ GS-9 – 4% - ☒ GS-11 – 14% - ☒ GS-12 – 28% - ☒ GS-13 – 28% - ☒ GS-14 – 10% - ☐ GS-15 – redacted** *10% of all 421s are in non-GS pay plans and excluded from this GS distribution **Percentages below 3% and below are redacted
On Ramps	The following work roles are examples of logical roles an individual may perform prior to transitioning into the 421-Database Administrator work role: - 411-Technical Support Specialist - 422-Data Analyst - 431-Knowledge Manager - 441-Network Operations Specialist - 451-System Administrator
Off Ramps	The following work roles are examples of common transitions an individual may pursue after having performed the 421-Database Administrator. This is not an exhaustive list, nor does it take into account learning and development opportunities an individual may pursue to prepare themselves for performing alternate work roles: - 422-Data Analyst - 441-Network Operations Specialist - 451-System Administrator - 621-Software Developer - 641-Systems Requirements Planner *Note: Leveraging the knowledge, skills, abilities, and tasks of the 421-Database Administrator work role, individuals may prepare themselves to transition into one or more of the following cross-functional work roles: - *711- Cyber Instructional Curriculum Developer* - *712-Cyber Instructor* - *732-Privacy Compliance Manager / Officer* - *751-Cyber Workforce Developer and Manager* - *752-Cyber Policy and Strategy Planner* - *802-IT Project Manager* - *803-Product Support Manager*

1.2 CORE TASKS

The table below provides a list of tasks that represent the Core, or baseline, expectations for performance in the 421-Database Administrator work role, as well as additional tasks that those in this role may be expected to perform.

Table 2. 421-Database Administrator Core Tasks

Task ID	Task Description	Core or Additional
T0008	Analyze and plan for anticipated changes in data capacity requirements.	Core
T0137	Maintain database management systems software.	Core
T0152	Monitor and maintain databases to ensure optimal performance.	Core
T0162	Perform backup and recovery of databases to ensure data integrity.	Core
T0305	Performs configuration management, problem management, capacity management, and financial management for databases and data management systems.	Core
T0306	Supports incident management, service-level management, change management, release management, continuity management, and availability management for databases and data management systems.	Core
T0422	Implement data management standards, requirements, and specifications.	Core
T0490	Install and configure database management systems and software.	Core
T0139	Maintain directory replication services that enable information to replicate automatically from rear servers to forward units via optimized routing.	Additional
T0140	Maintain information exchanges through publish, subscribe, and alert functions that enable users to send and receive critical information as required.	Additional
T0146	Manage the compilation, cataloging, caching, distribution, and retrieval of data.	Additional
T0210	Provide recommendations on new database technologies and architectures.	Additional
T0330	Maintain assured message delivery systems.	Additional
T0459	Implement data mining and data warehousing applications.	Additional

1.3 CORE KNOWLEDGE, SKILLS, AND ABILITIES

The table below provides a ranking of KSAs that represent the Core, or baseline, expectations for performance in the 421-Database Administrator work role, as well as additional KSAs that those in this role may be expected to demonstrate.

Table 3. 421-Database Administrator Core KSAs

KSA ID	Description	Competency	Importance to Work Role
K0004	Knowledge of cybersecurity and privacy principles.	Information Systems/Network Security	Foundational to All Work Roles
K0001	Knowledge of computer networking concepts and protocols, and network security methodologies.	Infrastructure Design	Foundational to All Work Roles
K0003	Knowledge of laws, regulations, policies, and ethics as they relate to cybersecurity and privacy.	Legal, Government, and Jurisprudence	Foundational to All Work Roles
K0002	Knowledge of risk management processes (e.g., methods for assessing and mitigating risk).	Risk Management	Foundational to All Work Roles
K0005	Knowledge of cyber threats and vulnerabilities.	Vulnerabilities Assessment	Foundational to All Work Roles
K0006	Knowledge of specific operational impacts of cybersecurity lapses.	Vulnerabilities Assessment	Foundational to All Work Roles
K0021	Knowledge of data backup and recovery.	Business Continuity	Core
K0020	Knowledge of data administration and data standardization policies.	Data Management	Core
S0042	Skill in maintaining databases. (i.e., backup, restore, delete data, transaction log files, etc.).	Database Administration	Core
S0045	Skill in optimizing database performance.	Database Administration	Core
K0023	Knowledge of database management systems, query languages, table relationships, and views.	Database Management Systems	Core
K0069	Knowledge of query languages such as SQL (structured query language).	Database Management Systems	Core
K0022	Knowledge of data mining and data warehousing principles.	Data Management	Additional
K0083	Knowledge of sources, characteristics, and uses of the organization's data assets.	Data Management	Additional
K0097	Knowledge of the characteristics of physical and virtual data storage media.	Data Management	Additional
K0260	Knowledge of Personally Identifiable Information (PII) data security standards.	Data Privacy and Protection	Additional
K0261	Knowledge of Payment Card Industry (PCI) data security standards.	Data Privacy and Protection	Additional
K0262	Knowledge of Personal Health Information (PHI) data security standards.	Data Privacy and Protection	Additional
K0420	Knowledge of database theory.	Database Administration	Additional
S0002	Skill in allocating storage capacity in the design of data management systems.	Database Administration	Additional
A0176	Ability to maintain databases. (i.e., backup, restore, delete data, transaction log files, etc.).	Database Administration	Additional
K0278	Knowledge of current and emerging data remediation security features in databases.	Database Administration	Additional
K0197	Knowledge of database access application programming interfaces (e.g., Java Database Connectivity [JDBC]).	Database Management Systems	Additional

KSA ID	Description	Competency	Importance to Work Role
S0013	Skill in conducting queries and developing algorithms to analyze data structures.	Database Management Systems	Additional
S0037	Skill in generating queries and reports.	Database Management Systems	Additional
K0025	Knowledge of digital rights management.	Encryption	Additional
K0277	Knowledge of current and emerging data encryption (e.g., Column and Tablespace Encryption, file and disk encryption) security features in databases (e.g. built-in cryptographic key management features).	Encryption	Additional
K0031	Knowledge of enterprise messaging systems and associated software.	Enterprise Architecture	Additional
K0056	Knowledge of network access, identity, and access management (e.g., public key infrastructure, Oauth, OpenID, SAML, SPML).	Identity Management	Additional
K0065	Knowledge of policy-based and risk adaptive access controls.	Identity Management	Additional
K0287	Knowledge of an organization's information classification program and procedures for information compromise.	Information Management	Additional
K0060	Knowledge of operating systems.	Operating Systems	Additional

1.4 CORE COMPETENCIES

The table below is a compilation of competencies aligned to the 421-Database Administrator work role, and their associated importance. Listed competencies are collections of three or more similar Knowledge, Skills, or Abilities aligned to the Work Role. *These competencies originate from the [NICE Framework Competency Pivot Tool](#).*

Table 4. 421-Database Administrator Core Competencies

Technical Competency	Comp. ID	Definition	Work Role Related KSAs	Importance
Database Administration	C015	This area contains KSAs that relate to managing and maintaining database management systems (DBMS) software	• Knowledge of current and emerging data remediation security features in databases. (K0278) • Knowledge of database theory. (K0420) • Skill in allocating storage capacity in the design of data management systems. (S0002) • Skill in maintaining databases. (i.e., backup, restore, delete data, transaction log files, etc.). (S0042) • Skill in optimizing database performance. (S0045) • Ability to maintain databases. (i.e., backup, restore, delete data, transaction log files, etc.). (A0176)	Core
Database Management Systems	C016	This area contains KSAs that relate to the use of database management systems and software to control the organization, storage, retrieval, security, and integrity of data.	• Knowledge of database management systems, query languages, table relationships, and views. (K0023) • Knowledge of query languages such as SQL (structured query language). (K0069) • Knowledge of database access application programming interfaces (e.g., Java Database Connectivity [JDBC]). (K0197) • Skill in conducting queries and developing algorithms to analyze data structures. (S0013) • Skill in generating queries and reports. (S0037)	Core
Data Management	C013	This area contains KSAs that relate to the development and execution of data management plans, programs, practices, processes, architectures, and tools that manage, control, protect, deliver, archive, dispose of, and enhance the value of data and information assets.	• Knowledge of data administration and data standardization policies. (K0020) • Knowledge of data mining and data warehousing principles. (K0022) • Knowledge of sources, characteristics, and uses of the organization's data assets. (K0083) • Knowledge of the characteristics of physical and virtual data storage media. (K0097)	Core

Technical Competency	Comp. ID	Definition	Work Role Related KSAs	Importance
Data Privacy and Protection	C014	This area contains KSAs that relate to the relationship between the collection and dissemination of data, technology, the public expectation of privacy, legal and political issues surrounding them	• Knowledge of Personally Identifiable Information (PII) data security standards. (K0260) • Knowledge of Payment Card Industry (PCI) data security standards. (K0261) • Knowledge of Personal Health Information (PHI) data security standards. (K0262)	Additional

1.5 SUGGESTED QUALIFICATIONS / CAPABILITY INDICATORS

Table 5. 421-Database Administrator Suggested Qualifications / Capability Indicators

For indicators of capability for the 421-Database Administrator work role, please see Draft NISTR 8193 - National Initiative for Cybersecurity Education (NICE) Framework Work Role Capability Indicators.

Section to be populated with updated DoD-8140 Qualification Matrix for 421-Database Administrator.

2 APPENDIX: 421-DATABASE ADMINISTRATOR TASK ANALYSIS AND KSA MAPPING

2.1 KEY TO READING THE TASK ANALYSIS AND KSA MAPPING

Table 6. Key to Reading the Task Analysis and KSA Mapping

Proficiency	Task Statement	Importance
As Written	Task as written within the NICE Cybersecurity Workforce Framework (NICE Framework).	Overall Importance to Work Role
Entry	*Example behavioral indicator / task permutation for performing this task at an Entry skills proficiency level.*	
Intermediate	*Example behavioral indicator / task permutation for performing this task at an Intermediate skills proficiency level.*	
Advanced	*Example behavioral indicator / task permutation for performing this task at an Advanced skills proficiency level.*	

Table 7. Primary Knowledge, Skills, and Abilities Required to Perform the above Task

KSA ID	Description	Competency
ID of K, S, or A	Knowledge, Skill or Ability needed to perform the task as written within the NICE Framework	Competency mapped to the individual K, S, or A.

2.2 421-DATABASE ADMINISTRATOR TASK ANALYSIS AND KSA MAPPING

Table 8. T0008 Task Analysis

Proficiency	Task Statement	Importance
As Written within Framework	Analyze and plan for anticipated changes in data capacity requirements.	Core
Entry	*Assist in analyzing and planning for anticipated changes in data capacity requirements.*	
Intermediate	*Delegate task for analyzing for specific capacity components. Analyze and plan for anticipated changes in data capacity requirements.*	
Advanced	*Assign tasks for analyzing capacity components. Develop an implementation plan based on business cycle and/or policy (e.g. agency specific or enterprise wide). Implement capacity requirement analysis. Perform quality control to confirm it meets criteria and protocol. Present recommend plan to management. Develop policy.*	

Table 9. Primary Knowledge, Skills, and Abilities Required to Perform the above Task

KSA ID	Description	Competency
K0021	Knowledge of data backup and recovery.	Business Continuity
K0020	Knowledge of data administration and data standardization policies.	Data Management
K0097	Knowledge of the characteristics of physical and virtual data storage media.	Data Management
S0002	Skill in allocating storage capacity in the design of data management systems.	Database Administration
S0042	Skill in maintaining databases. (i.e., backup, restore, delete data, transaction log files, etc.).	Database Administration
K0023	Knowledge of database management systems, query languages, table relationships, and views.	Database Management Systems
K0069	Knowledge of query languages such as SQL (structured query language).	Database Management Systems
K0060	Knowledge of operating systems.	Operating Systems

Table 10. T0422 Task Analysis

Proficiency	Task Statement	Importance
As Written within Framework	Implement data management standards, requirements, and specifications.	Core
Entry	*Apply organization standards, requirements, and specifications under supervision consistently with minimal errors.*	
Intermediate	*Implement and enforce data management standards, requirements, and specifications consistently and independently. Oversee training of junior staff.*	
Advanced	*Oversee and audit implementation of standards, requirements, and specifications. Develop enterprise-wide governance. Participate in policy review Boards or on policy review lifecycle.*	

Table 11. Primary Knowledge, Skills, and Abilities Required to Perform the above Task

KSA ID	Description	Competency
K0021	Knowledge of data backup and recovery.	Business Continuity
K0020	Knowledge of data administration and data standardization policies.	Data Management
K0278	Knowledge of current and emerging data remediation security features in databases.	Database Administration
S0042	Skill in maintaining databases. (i.e., backup, restore, delete data, transaction log files, etc.).	Database Administration
A0176	Ability to maintain databases. (i.e., backup, restore, delete data, transaction log files, etc.).	Database Administration
K0023	Knowledge of database management systems, query languages, table relationships, and views.	Database Management Systems
K0277	Knowledge of current and emerging data encryption (e.g., Column and Tablespace Encryption, file and disk encryption) security features in databases (e.g. built-in cryptographic key management features).	Encryption
K0287	Knowledge of an organization's information classification program and procedures for information compromise.	Information Management

Table 12. T0490 Task Analysis

Proficiency	Task Statement	Importance
As Written within Framework	Install and configure database management systems and software.	Core
Entry	*Assist with the installation and configuration of database management systems and software under guidance; perform tasks in test/development environments.*	
Intermediate	*Develop, plan, and coordinate using standards, policies, and requirements to implement software/systems. Independently review the software/systems and install database management systems and software.*	
Advanced	*Oversee coordination of activities. Review and approve implementation plan to install and configure database and management system/software; perform post-implementation validation. Assess and perform change management requirements.*	

Table 13. Primary Knowledge, Skills, and Abilities Required to Perform the above Task

KSA ID	Description	Competency
K0021	Knowledge of data backup and recovery.	Business Continuity
K0020	Knowledge of data administration and data standardization policies.	Data Management
K0278	Knowledge of current and emerging data remediation security features in databases.	Database Administration
S0042	Skill in maintaining databases. (i.e., backup, restore, delete data, transaction log files, etc.).	Database Administration
S0045	Skill in optimizing database performance.	Database Administration
A0176	Ability to maintain databases. (i.e., backup, restore, delete data, transaction log files, etc.).	Database Administration
K0277	Knowledge of current and emerging data encryption (e.g., Column and Tablespace Encryption, file and disk encryption) security features in databases (e.g. built-in cryptographic key management features).	Encryption
K0060	Knowledge of operating systems.	Operating Systems

Table 14. T0137 Task Analysis

Proficiency	Task Statement	Importance
As Written within Framework	Maintain database management systems software.	Core
Entry	*Learn and understand the methods and procedures of maintaining the database management systems software; practice in sandbox environment. Under guidance, use approved software in the form of patches, updates, and/or version distributions to maintain database systems/software.*	
Intermediate	*Maintain database management systems software and monitoring tools. Acquire software in the form of patches, updates, and/or version distributions to maintain database systems/software.*	
Advanced	*Oversee coordination among test groups for implementation clearance. Oversee and approve the systems/software version implementation planning. Oversee timely application of security patches and fixes. Ensure and oversee licensing lifecycle asset management for software implementation.*	

Table 15. Primary Knowledge, Skills, and Abilities Required to Perform the above Task

KSA ID	Description	Competency
K0021	Knowledge of data backup and recovery.	Business Continuity
K0020	Knowledge of data administration and data standardization policies.	Data Management
S0002	Skill in allocating storage capacity in the design of data management systems.	Database Administration
S0042	Skill in maintaining databases. (i.e., backup, restore, delete data, transaction log files, etc.).	Database Administration
A0176	Ability to maintain databases. (i.e., backup, restore, delete data, transaction log files, etc.).	Database Administration
K0023	Knowledge of database management systems, query languages, table relationships, and views.	Database Management Systems
K0277	Knowledge of current and emerging data encryption (e.g., Column and Tablespace Encryption, file and disk encryption) security features in databases (e.g. built-in cryptographic key management features).	Encryption
K0060	Knowledge of operating systems.	Operating Systems

Table 16. T0152 Task Analysis

Proficiency	Task Statement	Importance
As Written within Framework	Monitor and maintain databases to ensure optimal performance.	Core
Entry	*Use basic performance monitoring, tracing, and reporting tools. Escalate the alerts to more senior staff. Conduct basic query review.*	
Intermediate	*Use advanced performance monitoring tools to monitor and maintain databases to ensure optimal performance. Recommend solutions/mitigations to performance issues and identify root cause. Set up controls/alerts for database performance. Conduct advanced query review. Inspect environment resources and database internal resources. Schedule regular maintenance jobs for performance issues.*	
Advanced	*Advise on troubleshooting techniques. Manage performance incidents by assigning appropriate DBA resources or coordinating with ancillary resources. Mentor junior DBAs. Manage database performance, evaluate reports, and organize teams for performance issue remediation. Serve as intermediary between upper management and staff; escalate issues as appropriate.*	

Table 17. Primary Knowledge, Skills, and Abilities Required to Perform the above Task

KSA ID	Description	Competency
S0042	Skill in maintaining databases. (i.e., backup, restore, delete data, transaction log files, etc.).	Database Administration
S0045	Skill in optimizing database performance.	Database Administration
A0176	Ability to maintain databases. (i.e., backup, restore, delete data, transaction log files, etc.).	Database Administration
K0023	Knowledge of database management systems, query languages, table relationships, and views.	Database Management Systems
K0069	Knowledge of query languages such as SQL (structured query language).	Database Management Systems
S0013	Skill in conducting queries and developing algorithms to analyze data structures.	Database Management Systems

Table 18. T0162 Task Analysis

Proficiency	Task Statement	Importance
As Written within Framework	Perform backup and recovery of databases to ensure data integrity.	Core
Entry	*Monitor and report on database backup outcomes/status. Participate in managing requirements of backup and recovery of databases. Fix simple backup and recovery failures.*	
Intermediate	*Perform backup and recovery of databases to ensure data integrity. Schedule backup RPOs, RTOs, based on business needs. Improve backup and restore performance. Recommend better hardware and perform or execute regular audit on restores and recoveries. Analyze and test disaster recovery or continuing operations scenarios.*	
Advanced	*Oversee strategic planning and data retention policy to ensure backup exercises and restore. Oversee capacity planning and requirements development. Implement or execute lifecycle policies.*	

Table 19. Primary Knowledge, Skills, and Abilities Required to Perform the above Task

KSA ID	Description	Competency
K0021	Knowledge of data backup and recovery.	Business Continuity
K0020	Knowledge of data administration and data standardization policies.	Data Management
K0097	Knowledge of the characteristics of physical and virtual data storage media.	Data Management
S0042	Skill in maintaining databases. (i.e., backup, restore, delete data, transaction log files, etc.).	Database Administration
A0176	Ability to maintain databases. (i.e., backup, restore, delete data, transaction log files, etc.).	Database Administration
K0069	Knowledge of query languages such as SQL (structured query language).	Database Management Systems
K0060	Knowledge of operating systems.	Operating Systems

Table 20. T0305 Task Analysis

Proficiency	Task Statement	Importance
As Written within Framework	Performs configuration management, problem management, capacity management, and financial management for databases and data management systems.	Core
Entry	*Assist with configuration management, problem management, capacity management, and financial management for databases.*	
Intermediate	*Performs configuration management, problem management, capacity management, and financial management for databases and data management systems. Perform cost/benefit analysis. Document changes to systems.*	
Advanced	*Oversee configuration management, problem management, capacity management, and financial management to meet budgetary planning requirements. Advise and recommend technologies to meet/support configuration management, problem management and capacity management, and fiscal concerns.*	

Table 21. Primary Knowledge, Skills, and Abilities Required to Perform the above Task

KSA ID	Description	Competency
K0020	Knowledge of data administration and data standardization policies.	Data Management
K0278	Knowledge of current and emerging data remediation security features in databases.	Database Administration
K0420	Knowledge of database theory.	Database Administration
S0002	Skill in allocating storage capacity in the design of data management systems.	Database Administration
S0042	Skill in maintaining databases. (i.e., backup, restore, delete data, transaction log files, etc.).	Database Administration
S0045	Skill in optimizing database performance.	Database Administration
A0176	Ability to maintain databases. (i.e., backup, restore, delete data, transaction log files, etc.).	Database Administration
K0023	Knowledge of database management systems, query languages, table relationships, and views.	Database Management Systems
K0069	Knowledge of query languages such as SQL (structured query language).	Database Management Systems
S0037	Skill in generating queries and reports.	Database Management Systems
K0277	Knowledge of current and emerging data encryption (e.g., Column and Tablespace Encryption, file and disk encryption) security features in databases (e.g. built-in cryptographic key management features).	Encryption
K0065	Knowledge of policy-based and risk adaptive access controls.	Identity Management
K0287	Knowledge of an organization's information classification program and procedures for information compromise.	Information Management
K0060	Knowledge of operating systems.	Operating Systems

Table 22. T0306 Task Analysis

Proficiency	Task Statement	Importance
As Written within Framework	Supports incident management, service-level management, change management, release management, continuity management, and availability management for databases and data management systems.	Core
Entry	*Assist in preparation in supporting incident management, service-level management, change management, release management, continuity management, and availability management for databases and data management systems.*	
Intermediate	*Understand the corporation and coordination needs and requirements to supports incident management, service-level management, change management, release management, continuity management, and availability management for databases and data management systems. Provide recommendation and suggestions to the advanced level DBA.*	
Advanced	*Provide recommendation and plans to the management team, communicate with the management team(s) for the best solution in in supporting incident management, service-level management, change management, release management, continuity management, and availability management for databases and data management systems.*	

Table 23. Primary Knowledge, Skills, and Abilities Required to Perform the above Task

KSA ID	Description	Competency
K0020	Knowledge of data administration and data standardization policies.	Data Management
K0287	Knowledge of an organization's information classification program and procedures for information compromise.	Information Management