

SEQ#	Category (Lv. 1)	Category (Lv. 2)	Item	Required/Optional
DS-001	Basic Mathematics	Fundamentals of Statistical Mathematics	To be able to calculate permutations and combinations using the expressions nPr and nCr .	Required
DS-002	Basic Mathematics	Fundamentals of Statistical Mathematics	To be able to explain the meaning of conditional probability.	Required
DS-003	Basic Mathematics	Fundamentals of Statistical Mathematics	To be able to explain the differences in the calculation of mean (additive mean), median, and mode.	Required
DS-004	Basic Mathematics	Fundamentals of Statistical Mathematics	To be able to calculate the variance and standard deviation of given data.	Required
DS-005	Basic Mathematics	Fundamentals of Statistical Mathematics	Explain the differences between the population mean and sample mean, and between the unbiased variance and sample variance.	Required
DS-006	Basic Mathematics	Fundamentals of Statistical Mathematics	Know the values of variance and mean of the standard normal distribution.	Required
DS-007	Basic Mathematics	Fundamentals of Statistical Mathematics	Explain the difference between a correlation function and a causal relationship.	Required
DS-008	Basic Mathematics	Fundamentals of Statistical Mathematics	Explain the difference between nominal, ordinal, interval, and proportional scales.	Required
DS-009	Basic Mathematics	Fundamentals of Statistical Mathematics	Explain the denominator and numerator of common correlation coefficients (Pearson).	Required
DS-010	Basic Mathematics	Fundamentals of Statistical Mathematics	Explain five or more representative probability distributions.	Required
DS-011	Basic Mathematics	Fundamentals of Statistical Mathematics	Know what distribution a binomial event can be approximated to as the number of samples increases.	Required
DS-012	Basic Mathematics	Fundamentals of Statistical Mathematics	Be able to calculate the strength of a relationship when the variables are either quantitative or qualitative.	Required
DS-013	Basic Mathematics	Fundamentals of Statistical Mathematics	Be able to explain Bayes' theorem.	Required
DS-014	Basic Mathematics	Basic linear algebra	Understand how to calculate the inner product of vectors, and be able to express linear forms in terms of the inner product of vectors.	
DS-015	Basic Mathematics	Basic linear algebra	Understand how to calculate matrices, matrices and vectors correctly, and express multiple linear expressions as products of matrices.	
DS-016	Basic Mathematics	Basic linear algebra	Understand the definition of inverse matrix and how to solve simultaneous equations in matrix notation by calculating inverse matrix.	
DS-017	Basic Mathematics	Basic linear algebra	Understand the meaning of eigenvectors and eigenvalues.	
DS-018	Basic Mathematics	Fundamentals of differential and integral calculus	Understand that derivatives calculated by differentiation are expressions for determining slope.	

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DS-019	Basic Mathematics	Fundamentals of differential and integral calculus	Understand how to calculate partial derivatives for functions of two or more variables.	
DS-020	Basic Mathematics	Fundamentals of differential and integral calculus	Understand the relationship between integration and area, and explain that probability can be obtained by definite integration of the probability density function.	
DS-021	Forecasting	Regression/Classification	Understand the relationship between integration and area, and explain that probability can be obtained by definite integration of a probability density function.	Required
DS-022	Forecasting	Regression/Classification	To be able to explain partial regression coefficients, standard partial regression coefficients, and multiple correlations in multiple regression analysis.	
DS-023	Forecasting	Evaluation	Evaluate the accuracy of a model using the ROC curve and AUC (Area under the curve).	
DS-024	Forecasting	Evaluation	To be able to understand and evaluate the accuracy of evaluation measures such as confusion matrix (cross table of positive and negative distributions), Accuracy, Precision, Recall, and F-value.	
DS-025	Forecasting	Evaluation	Understand evaluation measures such as MSE (Mean Square Error) and MAE (Mean Absolute Error), and be able to evaluate their accuracy.	Required
DS-026	Forecasting	Evaluation	Understand the mechanism of the holdout method and cross-validation method, and be able to create training data, validation data for parameter tuning, and test data.	
DS-027	Forecasting	Evaluation	Understand that for data whose structure changes over time, the training data should be past data and the test data should be future data.	
DS-028	Testing / Judgment	Test/Decision	Be able to explain the difference between point estimation and interval estimation.	
DS-029	Testing / Judgment	Test/Decision	Explain the difference between the null hypothesis and the alternative hypothesis.	
DS-030	Testing / Judgment	Test/Decision	To be able to explain the meaning of Type 1 error, Type 2 error, p-value, and significance level.	
DS-031	Testing / Judgment	Test/Decision	Explain the difference between a one-tailed test and a two-tailed test.	
DS-032	Testing / Judgment	Test/Decision	To be able to select and apply an appropriate test method, taking into account the existence of correspondence between the data to be estimated.	
DS-033	Grouping	Grouping	To be able to explain the difference between classification (discriminant) models in supervised learning and grouping (clustering) in unsupervised learning.	

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DS-034	Grouping	Grouping	To be able to explain the difference between hierarchical cluster analysis and non-hierarchical cluster analysis.	
DS-035	Grouping	Grouping	Understand how to read a dendrogram in hierarchical cluster analysis, and be able to interpret it appropriately.	
DS-036	Grasping the nature and relationship	Understanding of properties and relationships	To be able to create histograms with appropriate interval data settings and explain how the data varies.	Required
DS-037	Grasping the nature and relationship	Understanding of properties and relationships	To be able to create crosstabulation tables with appropriate axis settings and understand the bias of data among attributes.	Required
DS-038	Grasping the nature and relationship	Understanding of properties and relationships	To be able to draw scatter plots of quantitative variables and understand the relationship between two variables.	Required
DS-039	Sampling	Sampling	To be able to explain what a sample error is.	Required
DS-040	Sampling	Sampling	To be able to outline the design of experiments.	
DS-041	Data visualization	Directional definition	To be able to give an overview of the range of objectives in visualization (from simply supporting work in the field to dynamically displaying the relationships between elements in big data, etc.)	
DS-042	Data visualization	axis generation	To be able to identify appropriate candidates for vertical and horizontal axes in scatter plots.	Required
DS-043	Data visualization	axis generation	To be able to select appropriate stratification (comparison axis) candidates, for example, when selecting attributes in a stacked vertical bar chart.	Required
DS-044	Data visualization	Data Processing	To be able to reduce the amount of data to an appropriate level by sampling and ensemble averaging.	
DS-045	Data visualization	Expression and implementation techniques	Determine the appropriate information density (e.g., data ink ratio)	
DS-046	Data visualization	Expression and implementation techniques	Understand the basics of axis expression to avoid unnecessary exaggeration (e.g., in principle, the reference point for the Y axis of a column chart should start at "0" and the axis should not be cut off).	Required
DS-047	Data visualization	Expression and implementation techniques	Understand the effects of emphases and clearly inappropriate emphases (e.g., position and size expressions are more effective than color expressions for measurement data).	Required
DS-048	Data visualization	Expression and implementation techniques	To be able to use BI tools, spreadsheets, etc. to create charts and graphs according to the purpose (comparison, composition, distribution, change, etc.) of one- to three-dimensional comparisons	Required
DS-049	Data visualization	Expression and implementation techniques	To be able to visualize changes in charts and graphs in a straightforward manner using animation (e.g., to show how a demographic histogram changes over time)	

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DS-050	Data visualization	Expression and implementation techniques	To be able to visualize data as a sign that conveys the meaning of the data to people other than the data analysis department	
DS-051	Data visualization	Expression and implementation techniques	Be able to explain the concept of Voronoi diagrams and how to use them	
DS-052	Data visualization	Expression and implementation techniques	To be able to appropriately visualize multivariate comparisons extending 1 to 3 dimensional charts (parallel coordinates, scatter plot matrices, table lenses, heat maps, etc.)	
DS-053	Data visualization	Semantic Extraction	Understand the importance of visualizing and viewing data in order to understand the nature of data	Required
DS-054	Data visualization	Semantic Extraction	Understand the importance of visualizing and viewing data to understand the nature of data.	
DS-055	Data visualization	Semantic Extraction	To be able to identify basic perspectives in data visualization (e.g., finding singularities, differences, trends, and relationships)	
DS-056	Analysis process	Approach Design	To be able to select necessary data, analysis methods, visualization, etc., if the scope and contents are clearly defined.	
DS-057	Data understanding and validation	Correct understanding of statistical information	To be able to understand the message of numbers and graphs when they come in contact with statistical information in news articles, etc.	
DS-058	Data understanding and validation	Data verification	Be able to check single graphs for aggregation errors.	Required
DS-059	Data understanding and validation	Data verification	Be able to correctly verify data items and the quantity and quality of data under instructions, and explain the results.	
DS-060	Data understanding and validation	Overlooking and meta-thinking	Understand the importance of considering the background of the data and not just taking it for granted	
DS-061	Data understanding and validation	Data understanding	Understand the importance of setting the starting points for aggregation and comparison targets in order to correctly highlight facts from data.	Required
DS-062	Data understanding and validation	Data understanding	Be able to explain the triggers, timing, and frequency of occurrence of the data they handle in their daily work, and have a grasp of basic statistics.	
DS-063	Data understanding and validation	Data understanding	Be able to aggregate data in accordance with the purpose of what the data is being aggregated for and what kind of knowledge is being obtained.	Required
DS-064	Extraction of implications Extraction, insights	Insight	To be able to extract direct implications from analyses and figures. (e.g., variability, significance, distribution trend, specificity, relevance, inflection point, high/low relevance)	

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DS-065	Extraction of implications Extraction, insights	Insight	To be able to interpret the numerical values of distribution results objectively without being influenced by assumptions.	
DS-066	Time series analysis	Time series analysis	To be able to explain what time series data is and its basic handling. (Time series graphs, periodicity, moving average, etc.)	
DS-067	Problem definition	KPI	Understand the key variables (KPI) of the business for which he/she is responsible, in addition to the general profit equation.	
DS-068	Problem definition	Scoping	Explain the market size, major players, dominant business models, challenges and opportunities in the business domain for which they are responsible.	
DS-069	Problem definition	Scoping	Understand the basic issue framework for the issue area being addressed, if it is a business area for which they are primarily responsible. (Organize procurement activities in terms of 5 forces, organize CRM issues in terms of RFM, etc.)	Required
DS-070	Data Acquisition	Data Acquisition	Given a hypothesis or known problem, be able to identify and secure access to the necessary data.	Required
DS-071	Language Processing	Language processing	Be able to perform typical cleaning processes (lowercasing, numeric substitution, half-width conversion, symbol removal, stemming, etc.) on text data as appropriate to the task.	
DS-072	Language Processing	Language processing	To be able to explain the concepts of morphological analysis and entailment analysis.	
DS-073	Image and video processing	Image processing	Know the mechanism of digital representation of images and typical image formats.	
DS-074	Image and video processing	Image processing	To be able to perform appropriate color conversion and simple filter processing on images according to the purpose.	
DS-075	Image and video processing	Image processing	Be able to perform typical cleaning processes (resizing, battening, standardization, etc.) on image data as appropriate to the task.	
DS-076	Image and video processing	Video Processing	Understand the mechanism of digital representation of video and typical video formats, and be able to use existing methods for extracting images from video.	
DS-077	Pattern discovery	Pattern Discovery	Able to evaluate the relationship between condition X and event Y using lift values.	
DS-078	Data processing	Data cleansing	Be able to convert variables in a naming scale into dummy variables.	Required
DS-079	Data processing	Data cleansing	Know what standardization is, and be able to standardize appropriately.	Required

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DS-080	Data processing	Data cleansing	Know what outliers, anomalies, and missing values are, and be able to detect, remove, and deal with variables appropriately under instructions.	Required
DS-081	Data processing	Data Processing	Able to design and execute categorization and binning of quantitative variables as necessary, based on analysis requirements and distribution of each variable.	
DS-082	Data processing	Filtering process	Able to filter data of hundreds of thousands of records by specifying conditions. (e.g., extract data that matches or does not match a specific value, extract data in a specific range, extract substrings, etc.)	Required
DS-083	Data processing	Filtering process	To be able to use regular expressions to extract data that matches the conditions. (e.g. judging whether an email address meets the format)	
DS-084	Data processing	Sorting process	To be able to sort by specific columns among records for data with hundreds of thousands of records, and to be able to sort by columns for data with thousands of records.	Required
DS-085	Data processing	Coupling	Able to perform inner join, outer join, and self-join based on a single condition for data of several hundred thousand records, and to perform UNION processing.	Required
DS-086	Data processing	Cleansing process	For data with hundreds of thousands of records, be able to remove records with null values, unexpected or out-of-range data, or convert them to the specified values.	Required
DS-087	Data processing	Mapping process	For data with hundreds of thousands of records, be able to express one value with another specified value, such as converting against a specified list or converting from prefecture to geocode.	Required
DS-088	Data processing	Sampling process	Extract data randomly or at regular intervals from hundreds of thousands of records.	Required
DS-089	Data processing	Aggregate processing	Calculate the sum, maximum value, minimum value, and number of records for hundreds of thousands of records.	Required
DS-090	Data processing	Conversion and arithmetic processing	To be able to perform arithmetic operations on data with hundreds of thousands of records, and to convert numerical data into other data types such as date and time data.	Required
DS-091	Data sharing	Data output	To be able to convert and export the results of processing and analysis into a specified format such as CSV, XML, JSON, or Excel.	Required
DS-092	Data sharing	Data output	To be able to insert records of processing and analysis results according to the table specifications of the destination DB.	Required
DS-093	Data sharing	Data expansion	Obtain necessary data using Web API (REST) and Web services (SOAP) for data acquisition.	

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DS-094	Data sharing	Data Linking	Download necessary data files from FTP, file sharing, etc., and import them into spreadsheet software such as Excel for use.	Required
DS-095	Data sharing	Data Linking	To be able to publish a new report by using the report editing function of BI tools.	
DS-096	Data sharing	Data Linking	To be able to extract necessary data and create graphs by using the free search function of BI tools.	
DS-097	Environment building	System operation	To be able to construct and operate a system of 1 to 10 servers with instructions.	
DS-098	Environment building	System operation	Be able to perform routine operations such as backup and archive creation for databases with hundreds of thousands of records.	
DS-099	Environment building	System planning	Able to create small-scale Excel datasets by using some data extraction methods from databases.	Required
DS-100	Environment building	System planning	Be able to organize the requirements for an analysis system that collects and utilizes open data.	
DS-101	Data collection	Client Techniques	Outline the functions (SDK, API, etc.) provided by the target platform.	
DS-102	Data collection	Client Techniques	To be able to use web crawlers and scripting tools to collect static content on websites as data for analysis.	
DS-103	Data collection	Communication skills	To be able to implement functions for storing data at the collection destination using the functions provided by the target platform (HTTP, FTP, SSH, etc.).	Required
DS-104	Data structure	Basic Knowledge	Be able to determine whether the data to be handled is structured data (customer data, product data, inventory data, etc.) or unstructured data (miscellaneous text, audio, images, video, etc.).	Required
DS-105	Data structure	Basic Knowledge	Understand relationships between tables by reading ER diagrams.	Required
DS-106	Data structure	Table definition	To be able to normalize tables using normalization methods (first normalization to third normalization).	
DS-107	Data Storage	DWH	Be able to connect to DWH appliances (Oracle Exadata, IBM Integrated Analytics System, Teradata, etc.) and extract composite data from multiple tables.	
DS-108	Data Storage	Dispersion techniques	Understand the basic structure and configuration of Hadoop and Spark distributed technologies.	
DS-109	Data Storage	Dispersion techniques	Able to access NoSQL data stores (Hbase, Cassandra, Mongo DB, CouchDB, Redis, Amazon, DynamoDB, Cloudant, Azure Cosmos DB, etc.) via API and register new data.	

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DS-110	Data Storage	Crowding	Connect to cloud-based storage services (Amazon S3, Google Cloud Starge, IBM Cloud Object Storage, etc.) and store data.	
DS-111	Programming	Basic Programming	Be able to programmatically implement data processing (extraction, processing, analysis, etc.) for handling small-scale structured data (CSV, RDB, etc.) based on a design document.	Required
DS-112	Programming	Data interface	Design and implement programs using APIs to pass data in standard formats such as JSON and XML.	
DS-113	Programming	Analysis programs	Be able to analyze data and create reports using an interactive development environment such as Jupyter Notebook or Rstudio.	
DS-114	Programming	SQL	Know, write, and execute SQL syntax (DML, DDL, use of JOINS, aggregate functions and GROUP BY, vertical and horizontal conversion using CASE statements, use of subqueries and EXISTS, etc.)	
DS-115	IT Security	Basic Knowledge	Be able to explain the three elements of security (confidentiality, availability, and integrity) using concrete examples.	Required
DS-116	IT Security	Attack and defense methods	Be able to explain the three elements of security (confidentiality, availability, and integrity) using specific examples, and be aware of the types of serious risks (loss, leakage, service interruption, etc.) caused by malware, etc.	Required
DS-117	IT Security	Attack and defense methods	Be able to set the access level for each user to OS, network, application, and data according to the procedure.	
DS-118	IT Security	Cryptography	Understand that unencrypted data can be easily misused by unauthorized persons, and be able to encrypt and decrypt data using software according to the degree of confidentiality.	Required
DS-119	IT Security	Cryptography	Understand that digital signatures and public key infrastructure (PKI) are necessary to prove that a document is not spoofed or forged.	
DS-120	IT Security	Cryptography	Be able to use hash functions to detect data tampering.	
DS-121	Code of Conduct	Data ethics	Have ethics appropriate for a person who handles data. (Do not falsify, alter, or plagiarize data, etc.)	Required
DS-122	Code of Conduct	Compliance	Understand laws and regulations related to personal information (e.g., Personal Information Protection Act, EU General Data Protection Regulation (GDPR)) and an overview of anonymized processed information, and be able to explain the points to be observed.	Required
DS-123	Machine Learning Techniques	Machine Learning	Know the names of at least three analysis methods for machine learning, and be able to give an overview of the methods.	

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DS-124	Machine Learning Techniques	Machine Learning	Have used machine learning models as instructed, and understand what kind of problems they can solve.	
DS-125	Machine Learning Techniques	Machine Learning	Understand the difference between "supervised learning" and "unsupervised learning".	Required
DS-126	Machine Learning Techniques	Machine Learning	Explain what overlearning is and the problems it can cause.	Required
DS-127	Machine Learning Techniques	Machine Learning	To be able to explain what a curse of dimensionality is and the problems it causes.	
DS-128	Machine Learning Techniques	Machine Learning	Explain the need for annotation in supervised learning.	
DS-129	Machine Learning Techniques	Machine Learning	Understand the risk that the output of the model will behave in a discriminatory manner when the observed data contains bias, or when the learned predictive model recognizes minority data as noise.	
DS-130	Machine Learning Techniques	Machine Learning	Understand the difference between global explanations (e.g., the contribution of each variable per model) and local explanations (e.g., the contribution of each variable per record to be predicted) in machine learning.	
DS-131	Code of Conduct	Business Mindset	Recognize the importance of logic and data in business and be able to act based on an analytical and data-driven mindset.	Required
DS-132	Code of Conduct	Business Mindset	Understand that analyzing data without a set of goals and objectives will not yield any meaningful results.	Required
DS-133	Code of Conduct	Business Mindset	Understand the importance of verbalizing issues and hypotheses.	Required
DS-134	Code of Conduct	Business Mindset	Understand the importance of being in contact with primary information, such as by visiting and interviewing sites.	Required
DS-135	Logical thinking	MECE	Be able to recognize duplication of data and events.	Required
DS-136	Logical thinking	Verbalization skills	Able to correctly verbalize the implications of analysis results in the case of commonly observed phenomena.	Required
DS-137	Logical thinking	Story line	Understand the general structure of a paper. (Introduction, Approach, Result, Discussion, Conclusion, etc.)	
DS-138	Logical thinking	Documentation	Be able to theoretically summarize a document of one figure or several figures. (Issue background, approach, results of discussion, implications, next steps)	
DS-139	Logical thinking	Explanatory skills	To be able to understand the other party's argument promptly when the other party points out the lack of argument or logical breakdown in the report.	Required

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DS-140	Activity management	Project launch	To be able to explain the difference between waterfall development and agile development.	
DS-141	Activity management	Resource Management	To be able to follow instructions and follow a schedule, and to be able to complete one's own work as requested by the team leader.	Required
DS-142	Activity management	Risk Management	Be able to quickly and appropriately report any delays or failures in the tasks for which they are responsible.	Required
DS-143	Understanding data from a business perspective	Data understanding	Understand the importance of looking at data with a hypothesis from a business perspective, and the possibility that results that differ from the hypothesis may still be important insights.	Required
DS-144	Understanding data from a business perspective	Semantic Extraction, Insight	Understand the importance of looking at data with a hypothesis, and that even if the results are different from the hypothesis, they may be important findings.	
DS-145	Contracts and Rights Protection	Contracts	To be able to explain the difference between a contract and an associate contract.	
DS-146	Implementation in business	Evaluation and improvement mechanisms	Understand the importance of monitoring the results and the degree of improvement.	Required