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MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE RUSSIAN FEDERATION
Federal State Autonomous Educational Institution
Higher Education
"NORTH CAUCASUS FEDERAL UNIVERSITY"

APPROVED BY
Acting Director of the Institute
Advanced Engineering
A.A. Porokhnya

DISCIPLINE ASSESSMENT TOOLS FUND
"Statistical Methods in Machine Learning"

Field of study	11.03.02 Infocommunication Technologies and Communication Systems
Profile	Intelligent Data Processing in Infocommunication Systems and Networks
Year of start of training	Oct. 2025
Form of study	Full-time
Implemented in a semester	3

Introduction

1. Purpose

The fund of assessment tools for the discipline "Statistical Methods in Machine Learning" is designed to objectively assess the level of competence formation.

2. FOS is an appendix to the program of the discipline "Artificial Intelligence and Machine Learning".

3. The developer is R. A. Voronkin, Associate Professor of the Department of Digital, Robotic Systems and Electronics of the Institute of Advanced Engineering.

4. An examination of the FOC was carried out.

Members of the expert group:

Chairman: N.Y. Bratchenko, Chairman of the CMT of the Institute of Advanced Engineering, Associate Professor of the Department of Digital, Robotic Systems and Electronics of the Institute of Advanced Engineering.

Members of the Commission:

V.P. Mochalov, Professor of the Department of Digital, Robotic Systems and Electronics of the Institute of Advanced Engineering.

S.V. Melnikov, Senior Researcher of the Interdisciplinary Training and Research Center for Agricultural Technologies, Associate Professor of the Department of Digital, Robotic Systems and Electronics of the Institute of Advanced Engineering.

Representative of the employer's organization:

Mironov V.A., General Director of Orintex LLC.

Expert opinion: The FAT for the discipline allows you to assess the level of competence formation. Start approbation.

5. The validity period of the FAT is determined by the period of implementation of the educational program.

1. Description of the criteria for assessing competence at various stages of their formation, description of assessment scales

Competence(s), indicator(s)	Levels of competence formation(s),			
	The minimum level has not been reached (Unsatisfactory) 2 points	Minimum level (satisfactory) 3 points	Intermediate level (good) 4 points	High level (excellent) 5 points
OPK-1				
Learning outcomes in the discipline (module): <i>Indicator:</i> ID-1 OPK-1 understands the fundamental laws of nature and the basic physical mathematical laws and methods of accumulating, transmitting and processing information.	Does not know and understands optimization methods in the design of AI and ML systems, is able to justify the choice.	Partially knows and understands optimization methods in the design of AI and ML systems, is able to justify the choice.	Knows and understands optimization methods in the design of AI and ML systems, is able to justify the choice.	Fully knows and understands optimization methods in the design of AI and ML systems, is able to justify the choice.
ID-2 OPK-1 applies physical laws and mathematical methods to solve problems of a theoretical and applied nature.	He does not know optimization methods, cannot apply them in practice.	Uses optimization techniques in a pattern or with errors.	Applies basic optimization techniques to typical tasks.	Uses optimization methods in the design of AI and ML systems, is able to justify the choice.
ID-3 OPK-1 uses the knowledge of physics and mathematics to solve practical problems.	Does not conduct analysis or does it formally, without conclusions.	Performs partial processing, draws primitive conclusions.	Confidently collects and analyzes data, forms reasonable conclusions.	Systematically assesses quality, offers recommendations for improvement, draws up an analytical report.

Assessment of the level of competence in the discipline is carried out on the basis of the "Regulation on the current monitoring of progress and intermediate certification of students in educational programs of higher education - bachelor's programs, specialist programs, master's programs - in the Federal State Autonomous Educational Institution of Higher Education "North Caucasus Federal University" in the current edition.

ASSESSMENT TOOLS FOR CHECKING THE LEVEL OF COMPETENCE FORMATION

Job Number	Correct answer	Content of the question	Competence
		Full-time, Semester 3	
1	Artificial intelligence is a field that studies methods for creating intelligent systems	Define the concept of "artificial intelligence"	OPK-1
2	Machine learning is a data analysis technique in which a model is trained from examples	What is machine learning?	OPK-1
3	Classification	Which of the following types of tasks is supervised learning?A) ClusteringB) Dimensionality reductionC) ClassificationD) Data compression	OPK-1
4	With training, without training, with partial training	What are the main approaches to learning in machine learning?	OPK-1
5	1. Data collection; 2. Preprocessing; 3. Training; 4. Evaluation; 5. Implementation	Streamline the stages of the machine learning project lifecycle: data preprocessing, model evaluation, data collection, model training, implementation	OPK-1
6	A training sample is a dataset that contains input features and corresponding target values	What is training sampling in machine learning tasks?	OPK-1
7	D) All of the above	What tasks can be solved with the help of AI?A) Diagnosis of diseasesB) Facial recognitionC) Classification of textsD) All of the above	OPK-1
8	A model is an algorithm trained on data and capable of making predictions	What is a model in machine learning?	OPK-1
9	C) Regression	What is the task of predicting a numerical value?A) ClassificationB) ClusteringC) RegressionD) Associations	OPK-1
10	Features are measurable characteristics of an object fed to the input of the model	What are features in machine learning?	OPK-1
11	To eliminate outliers, normalize and	Why is data preprocessing performed?	OPK-1

1	Artificial intelligence is a field that studies methods for creating intelligent systems	Define the concept of "artificial intelligence"	OPK-1
	improve model quality		
12	C) Train the model on labeled data	What does the term "supervised learning" mean?A) Instructor-led trainingB) Train the model on unlabeled dataC) Train the model on labeled dataD) Maintain the model after implementation	OPK-1
13	Supervised learning, unsupervised learning, reinforcement learning	List the main types of machine learning	OPK-1
14	C) Teaching without a teacher	What type of learning is used in clustering?A) Supervised learningB) Reinforcement learningC) Unsupervised learningD) Deep learning	OPK-1
15	Classification, regression, clustering, dimensionality, associations	Name at least four common machine learning tasks	OPK-1
16	C) Regression	What problem is solved by predicting a continuous quantity?A) ClassificationB) ClusteringC) RegressionD) Associations	OPK-1
17	C) Detection of groups of similar objects	What does the clustering algorithm do?A) Predicts a numberB) Detects a classC) Detects groups of similar featuresD) Converts data to text	OPK-1
18	Supervised learning requires labeled data; unsupervised learning does not	What is the fundamental difference between teaching with a teacher and without a teacher?	OPK-1
19	D) All of the above	Which of the following tasks are related to supervised learning?A) ClassificationB) RegressionC) Price predictionD) All of the following	OPK-1
20	A) The algorithm chooses actions, receiving rewards	What happens in reinforcement learning?A) The algorithm chooses actions to receive rewardsB) The model is trained on labeled dataC) The model is trained without target valuesD) Only logic is used	OPK-1
21	A regression model predicts real values, and classifications predict categories	What is the difference between a regression problem and a classification problem?	OPK-1

22	Associations are the task of finding common patterns in data	Explain what the task of association is in machine learning	OPK-1
23	D) All of the above	Which of the following are machine learning tasks?A) Predicting equipment failuresB) Analyzing customer behaviorC) Image segmentationD) All of the following	OPK-1
24	Study with a teacher	What type of learning is used in category and number prediction problems?	OPK-1
25	Missing values, outliers, type mismatches, duplicates	What are the main problems encountered in raw (raw) data	OPK-1
26	Standardization, normalization, coding of categorical features	List common data preprocessing techniques	OPK-1
27	C) Filling with an average value	Which method can be used to fill in missing values in a numerical characteristic?A) Delete all rowsB) Fill in with random valuesC) Fill in with an average valueD) Fill in with the text "unknown"	OPK-1
28	A feature is a measurable characteristic of an object fed to the input of the model	What is a feature in the context of machine learning?	OPK-1
29	D) Categorical and numerical	What types of features are usually distinguished in machine learning?A) Binary and textualB) Numerical and realC) Logical and symbolicD) Categorical and numerical	OPK-1
30	Missing values can reduce model accuracy and disrupt training sampling	Why is it important to handle missing values in the dataset?	OPK-1
31	One-hot encoding	What categorical feature coding method is used to create binary columns for each unique value?	OPK-1
32	Changing the shape and structure of features to improve model performance	What does the term "feature engineering" mean?	OPK-1
33	C) Selection of features, generation of new features, transformation of existing ones	What is included in the engineering process of feature processing?A) Deleting the modelB) Saving features to a fileC) Selecting features, generating new features, transforming existing onesD) Inserting random features	OPK-1
34	D) Min-Max scaling	Which normalization method converts values to a range	OPK-1

		from 0 to 1?A) Z-transformB) Binary codingC) Outlier removalD) Min-Max scaling	
35	Removing duplicates is necessary to prevent data distribution from being skewed	Why is it necessary to delete duplicate rows in the dataset?	OPK-1
36	A target feature is a variable that the model is trying to predict	What is a target feature in a supervised learning task?	OPK-1
37	Relationship between one dependent variable and one or more independent variables	What does linear regression model?	OPK-1
38	$y = w_0 + w_1x_1 + w_2x_2 + \dots + w_nx_n$	Specify the general linear regression equation	OPK-1
39	C) Continuous Variable	What type of variable does a linear regression model predict?A) CategoricalB) DiscreteC) ContinuousD) Logical	OPK-1
40	Estimating model coefficients based on a training sample	What does the process of training a linear regression model mean?	OPK-1
41	(A) Method of least squares	Which method is most commonly used to estimate linear regression parameters?A) Least squares methodB) Monte Carlo methodC) k-means methodD) principal component method	OPK-1
42	RMS error	Name one of the metrics used to evaluate the quality of a linear regression model	OPK-1
43	D) The closer to 1, the better the model explains the variance of the target variable	How is the coefficient of determination R^2 interpreted?A) It shows the probability of errorB) It is always zeroC) It depends only on the number of featuresD) The closer to 1, the better the model explains the variance of the target variable	OPK-1
44	Regularization reduces overfitting by penalizing large coefficients	What is the role of regularization in linear regression?	OPK-1
45	Yes, in the presence of multicollinearity, outliers, or non-linearity	Are there any limitations when applying linear regression? Give examples	OPK-1

46	Linear regression assumes a linear relationship between features and the target variable	What is the basic assumption made by a linear regression model?	OPK-1
47	A) Features should be scaled	What should be done before training a linear regression to improve its correctness?A) Features should be scaledB) Remove all categorical featuresC) Convert the target variable to a categorical variableD) Eliminate missing values without checking	OPK-1
48	Comparison of predicted values with actual values	How are the results of a linear regression model evaluated?	OPK-1
49	An optimization method in which model parameters are updated after each random sample	What is Stochastic Gradient Descent (SGD)?	OPK-1
50	C) One random example	How many features are used in a single step in a stochastic gradient descent?A) Entire training sampleB) Mini-batchC) One random exampleD) Two minimally error examples	OPK-1
51	To find the minimum loss function and update the model weights	Why is gradient descent used in machine learning?	OPK-1
52	The gradient indicates the direction of the greatest increase in the function, so the movement is in the opposite direction	Why does gradient descent move in the opposite direction of the gradient when training a model?	OPK-1
53	B) Learning Speed	What is the name of the parameter that determines the step length when updating the weights?A) RegularizationB) Learning rateC) Tree depthD) Feature size	OPK-1
54	Too much learning speed can lead to divergence, too little can lead to slow convergence	How does the speed of learning affect the optimization process?	OPK-1
55	In SGD, the parameters are updated more frequently, which can speed up learning but make it noisier	What is the difference between a stochastic gradient descent and a regular gradient descent?	OPK-1

56	Yes, for example: data shuffling, reducing the learning rate, using gradient averaging	Are measures possible to reduce SGD volatility? Give examples	OPK-1
57	A) Function that detects model error	What is the loss function in the context of SGD?A) Function that defines model errorB) Accuracy estimationC) Classification resultD) Number of incorrect answers	OPK-1
58	A mini batch gradient descent is a compromise between SGD and full gradient descent	What is a mini-batch gradient descent and what is its peculiarity?	OPK-1
59	C) Loss function, its gradient, and learning rate	What is needed for a single step of a stochastic gradient descent?A) Learning rate onlyB) Loss function onlyC) Gradient onlyD) Loss function, its gradient, and learning rate	OPK-1
60	Convergence means that the values of the model parameters are stabilized and the error reaches a minimum	What does the convergence of the gradient descent algorithm mean?	OPK-1
61	Overtraining is a situation where a model performs well on a training sample but performs poorly on new data	What is retraining in machine learning?	OPK-1
62	Adding a Complexity Penalty to the Loss Function	How does regularization help in the fight against overfitting?	OPK-1
63	A) L1 and L2	Which of the following methods are regularization types?A) L1 and L2B) PCA and SVDB) BatchNorm and DropoutD) SGD and Adam	OPK-1
64	L1 regularization nullifies some weights and promotes feature selection, L2 distributes the penalty evenly	What is the difference between L1 and L2 regularization?	OPK-1
65	Regularization reduces the absolute values of the model's weights, thereby reducing its complexity	What effect does regularization have on model parameters?	OPK-1
66	C) A model evaluation method in which data is divided into multiple subsets	What is cross-validation?A) Model selection methodB) Optimization algorithmC) Feature selection methodD)	OPK-1

		Model evaluation method, in which data is divided into several subsets	
67	Model robustness independent of a specific sample split	What is assessed using cross-validation?	OPK-1
68	Improves the reliability of model evaluation and helps identify overfitting	Why is cross-validation important when training a model?	OPK-1
69	D) Splitting the data into K parts and sequential training on K-1 parts with testing on the remaining parts	How does K-fold cross-validation work?A) Retraining on the same sampleB) Using external dataC) Hyperparameter selectionD) Splitting the data into K parts and sequential training on K-1 parts with testing on the remaining parts	OPK-1
70	C) A model that is too complex remembers data accurately rather than generalizing patterns	Why are complex models more likely to be overtrained?A) Due to lack of dataB) Due to regularizationC) Due to feature scalingD) A model that is too complex accurately remembers data rather than generalizing patterns	OPK-1
71	Yes, for example, the use of fewer features, model simplification, regularization, cross-validation	Is it possible to prevent overtraining? Name the ways	OPK-1
72	B) On the test sample	On which dataset should the model be tested for retraining?A) On the training sampleB) On the test sampleC) On the entire sampleD) On the sample without the target feature	OPK-1
73	A model for solving classification problems that predicts the probability of belonging to a class	What is logistic regression?	OPK-1
74	A) Sigmoid	Which function is used in logistic regression to derive probability?A) SigmoidB) GaussianC) PolynomialD) Logarithmic	OPK-1
75	Predictions in logistic regression are the probabilities of an object belonging to a positive class	What is the output of logistic regression to threshold conversion?	OPK-1
76	(B) Classification	What is logistic regression used for?A) RegressionB)	OPK-1

		ClassificationC) ClusteringD) Ranking	
77	D) A class decision is made based on a threshold (e.g. 0.5)	How does logistic regression convert probability to the predicted class?A) By the maximum weight of the featureB) By the number of featuresC) By the variance of the dataD) A class decision is made based on a threshold (e.g., 0.5)	OPK-1
78	C) Prediction of categorical meaning	What is the main task of logistic regression?A) Minimizing regression errorsB) Finding outliersC) Predicting categorical valueD) Finding cluster centers	OPK-1
79	D) Cross-entropy	What loss function does logistic regression use?A) Standard errorB) L1-regularizationC) Sum of weightsD) Cross-entropy	OPK-1
80	It compresses a linear combination of features into a range of 0 to 1	What is the role of sigmoid function in logistic regression?	OPK-1
81	Yes, for example, L2 regularization helps to avoid overfitting	Does regularization apply to logistic regression? Give an example	OPK-1
82	Model weights determine the contribution of each feature to the probability of being assigned to a class	How are logistic regression coefficients interpreted?	OPK-1
83	B) Improving the interpretability and stability of the model	What can regularization be used for in logistic regression?A) Speeding up the gradient descentB) Increasing the interpretability and stability of the modelC) Increasing the accuracy of the training sampleD) Increasing the number of features	OPK-1
84	Logistic regression works well with linear class separability	In what cases does logistic regression give good results?	OPK-1
85	Accuracy	Which classification metric reflects the proportion of correct answers among all predictions?	OPK-1
86	Precision — accuracy; Recall — completeness	What do the precision and recall metrics mean?	OPK-1
87	The F1 measure is the harmonic mean	How is the F1 measure calculated?	OPK-1

	between precision and recall		
88	D) 1.0	What is the importance of the F1 measure for an ideally accurate and complete classification?A) 0.0B) 0.5B) 0.8D) 1.0	OPK-1
89	A) Matrix, which indicates the number of correct and incorrect predictions by class	What is a confusion matrix?A) A matrix that indicates the number of correct and erroneous predictions by classB) A method for normalizing dataC) A method for selecting featuresD) The result of logistic regression	OPK-1
90	True Positive, True Negative, False Positive, False Negative	What are the four values used in the confusion matrix?	OPK-1
91	Completeness is important when it is critical not to miss a single positive case	In which tasks is completeness more important than accuracy?	OPK-1
92	D) ROC-AUC	Which metric measures the area under the error curve of the classifier at different thresholds?A) MAEB) R ² B) AccuracyD) ROC-AUC	OPK-1
93	The ROC curve is based on the True Positive Rate and False Positive Rate values	How is the ROC curve constructed?	OPK-1
94	B) Recall	Which metric can be increased by lowering the classification threshold?A) AccuracyB) RecallC) PrecisionD) R ²	OPK-1
95	Takes into account both false positives and missed cases	Why is the F1 measure considered a balanced metric?	OPK-1
96	Г) Precision и Recall	What two metrics do F1-score have in common?A) Accuracy and R ² B) AUC and ROCB) TP and FPG) Precision and Recall	OPK-1
97	A classification method in which an object belongs to the majority class among k nearest neighbors	What is the k nearest neighbor (k-NN) method?	OPK-1
98	A) Euclidean distance	What is the most commonly used distance measure in the k-NN method?A) Euclidean distanceB) CorrelationC)	OPK-1

		Product of features D) Cosine of angle	
99	The value of the k parameter determines the number of nearby objects participating in the vote	How does the k parameter affect the operation of the k-NN algorithm?	OPK-1
100	Classes are defined based on the position of features in the feature space	How is classification done in the k-NN algorithm?	OPK-1
101	The support vector method is an algorithm that looks for the optimal boundary between classes	What is Support Vector Method (SVM)?	OPK-1
102	B) Hyperplane	Which object does SVM use to separate classes? A) Probability curve B) Hyperplane C) Center of the cluster D) Convex shell	OPK-1
103	Support vectors are the features that are closest to the separating hyperplane and define its position	What are support vectors in SVM method?	OPK-1
104	D) Linear, polynomial, radial	Which nuclei can be used in SVMs? A) Linear only B) Gaussian only C) Logarithmic only D) Linear, polynomial, radial	OPK-1
105	Parameter C controls the balance between maximizing clearance and minimizing error	What is the effect of the C regularization parameter in the SVM method?	OPK-1
106	Yes, with a small k, the model can be overtrained, with a large k, it can be undertrained	Can the k-NN method suffer from overfitting? Explain.	OPK-1
107	D) SVM is resilient but sensitive to feature scaling	Which of the following is true for the SVM method? A) Not sensitive to feature scale B) Sensitive to distance metric selection C) Not requiring regularization D) Resilient to outliers, but sensitive to feature scaling	OPK-1
108	Preprocessing includes feature normalization, which is especially important for SVMs and k-NN	Why is it important to scale features before using SVM or k-NN?	OPK-1

109	An algorithm that builds a structure from sequential conditions separating data by features	What is a decision tree in machine learning?	OPK-1
110	A) Root node	Which element does the decision tree start with?A) Root nodeB) LeafC) Random nodeD) Midselection	OPK-1
111	Subset division to increase the homogeneity of the target variable	What is the basic principle of building a decision tree?	OPK-1
112	Gini index, entropy, variance	What are the criteria used to evaluate the quality of splitting in decision trees?	OPK-1
113	C) Node containing no descendants	What is a leaf in a decision tree?A) The first node of the treeB) A node that contains many objectsC) A node that contains no childrenD) Any intermediate node	OPK-1
114	Tree depth, minimum number of objects in a node, maximum number of features	What settings can limit the complexity of the tree and prevent overfitting?	OPK-1
115	D) Deep tree can be retrained	Which of the following is true for decision trees?A) Require scalingB) Do not work with categorical featuresC) Do not retrainD) Deep tree can be retrained	OPK-1
116	High interpretability, visualization, work with different types of features	What are the benefits of decision trees?	OPK-1
117	C) Comparison of error distribution and visualization of the tree structure	What methods are used to analyze the decision tree model?A) ROC curveB) Weight matrixC) Error distribution comparison and visualization of the tree structureD) Gradient descent	OPK-1
118	Yes, the tree can be displayed as a diagram with conditions and results	Is it possible to visualize a decision tree?	OPK-1
119	A) When using complex or retrained trees	When can a decision tree produce poor results on new data?A) When using complex or overtrained treesB) In the absence of categorical featuresC) With linear dependenceD) Only when using a random forest	OPK-1
120	The decision tree is the basis of many ensemble methods, such as random forest	What role do decision trees play in ensemble models?	OPK-1

	and gradient boosting		
121	Algorithms that combine multiple models to improve prediction quality	What are ensemble methods in machine learning?	OPK-1
122	A random forest is an ensemble of decision trees trained on random subsamples of data and features	What is a random forest algorithm?	OPK-1
123	A) Averaging (for regression) or voting (for classification)	What is the principle used to combine predictions in a random forest? A) Averaging or voting B) Choosing the best tree C) Multiplying outputs D) Sorting by weights	OPK-1
124	Improve model resiliency, reduce overfitting, improve accuracy	What are the advantages of using ensembles compared to single models?	OPK-1
125	Gradient boosting builds trees sequentially, with each new tree learning from the mistakes of the previous one	What is the main idea of gradient boosting?	OPK-1
126	B) Random Forest and Gradient Boosting	Which of the following models are ensemble models? A) Logistic Regression and SVM B) Random Forest and Gradient Boosting C) Decision Tree and PCA D) k-NN and DBSCAN	OPK-1
127	Random forest trains trees in parallel, gradient boosting trains sequentially	What is the difference between random forest and gradient boosting in the learning process?	OPK-1
128	Overtraining can occur when there are too many trees, depth, and high learning rates	Can gradient boosting be retrained? Give reasons	OPK-1
129	Параметры: <code>n_estimators</code> , <code>learning_rate</code> , <code>max_depth</code> и др.	What are the main parameters that affect the quality of the gradient boosting model	OPK-1
130	D) To assess the importance of features	What can <code>feature_importances_</code> be used for in ensemble models? A) To set up regularization B) To scale data C) To calculate metrics D) To assess the importance of features	OPK-1
131	Yes, ensembles can significantly improve model quality and noise tolerance	Can an ensemble of models surpass the quality of a single model? Explain.	OPK-1
132	B) Averaging predictions of multiple models	What does "bagging" mean in the context of ensembles? A) Train models sequentially B) Average	OPK-1

		predictions of multiple modelsC) Use only root nodesD) Manually select features	
133	Clustering is the task of dividing features into groups based on similarity without using class labels	What is clustering in machine learning?	OPK-1
134	A) KMeans	Which of the algorithms is most commonly used for clustering?A) KMeansB) Logistic RegressionC) Gradient boostingD) SVM	OPK-1
135	Cluster centers are the average coordinate values of all features in the cluster	What are cluster hubs in the KMeans method?	OPK-1
136	Reallocate facilities to nearby cluster centers and upgrade centers	Describe how the KMeans algorithm works iteratively	OPK-1
137	B) Number of clusters	What parameter should be set in advance in the KMeans algorithm?A) Maximum depthB) Number of clustersC) Learning rateD) Number of features	OPK-1
138	Yes, for example, agglomerative hierarchical clustering	Are there clustering methods that don't require you to specify the number of clusters? Give an example	OPK-1
139	D) Dendrogram	What is the name of the tree that reflects the process of combining objects in hierarchical clustering?A) Concordant matrixB) PlotC) CartogramD) Dendrogram	OPK-1
140	Yes, the scale of features affects the distances between points, and therefore the result of clustering	Does feature scaling affect the clustering result? Explain	OPK-1
141	D) The similarity of objects is determined by the distance between them	How is the similarity of objects determined during clustering?A) By cluster numberB) By loss functionC) By probability densityD) By distance between them	OPK-1
142	Visualization helps to understand the structure of clusters and their separation	Why visualize the clustering result in 2D space?	OPK-1
143	The quality of clustering can be evaluated using silhouette, intra-cluster distances, and other metrics	How can I assess the quality of clustering without class labels?	OPK-1

144	A) Presence of overlapping or elongated clusters	In what case can the KMeans algorithm work inefficiently?A) Presence of intersecting or extruded clustersB) Real featuresC) Same number of objects in classesD) Low number of features	OPK-1
145	The process of transforming data into a space of smaller dimensions while maintaining information content	What is dimensionality reduction?	OPK-1
146	A) Principal Component Analysis	What does the abbreviation PCA stand for?A) Principal Component AnalysisB) Partial Classification AlgorithmC) Primary Clustering ApproachD) Projection of Categorical Attributes	OPK-1
147	Transformation of initial features into new, orthogonal components with maximum dispersion	What Does PCA Method Do With Signs?	OPK-1
148	B) Preserve as much data variance as possible	What is the main purpose of the PCA method?A) Simplify the modelB) Preserve as much variance as possibleC) Reduce accuracyD) Eliminate categorical features	OPK-1
149	D) Number of principal components	What can be used as a parameter when reducing dimensionality with PCA?A) Learning rateB) Number of treesC) Kernel viewD) Number of principal components	OPK-1
150	Yes, for example, t-SNE or UMAP are nonlinear methods for visualizing high-dimensional data	Are there nonlinear methods for reducing dimensionality? Give an example	OPK-1
151	t-SNE is good at preserving the local data structure and visualizing clusters	What is the advantage of the t-SNE method for data visualization?	OPK-1
152	To identify data structure, clusters, outliers, assess model learning	Why Use Data Visualization After Dimensionality Reduction?	OPK-1
153	A) High dimensionality can interfere with model training and visual analysis	Why is it important to reduce dimensionality before rendering?A) High dimensionality can interfere with model training and visual analysisB) To increase training timeC) To increase varianceD) To replace all features with	OPK-1

		categorical features	
154	Scatter plot, color coding, class labels	How can you visualize the result of dimensionality reduction in 2D?	OPK-1
155	Yes, dimensionality reduction can simplify data interpretation and speed up learning	Can reducing dimensionality improve the efficiency of the model? Explain	OPK-1
156	A) Percentage of Explained Variance	What is used to estimate the informative value of principal components in PCA? A) Percentage of explained variance B) Correlation coefficient C) F1-measure D) Standard error	OPK-1
157	Hyperparameters are parameters that are set before the model is trained and do not change during training	What are hyperparameters in machine learning?	OPK-1
158	A) learning_rate, max_depth, n_estimators	Which of the following are the hyperparameters of the gradient boosting model? A) learning_rate, max_depth, n_estimators B) precision, recall, accuracy C) weight_1, weight_2 D) fit, transform	OPK-1
159	Find the combination of parameters in which the model shows the best results on validation data	What is the purpose of hyperparameter bringing?	OPK-1
160	C) GridSearchCV	Which method uses a full search of all possible combinations of hyperparameters? A) TrainTestSplit B) PCA V) RandomForest D) GridSearchCV	OPK-1
161	GridSearchCV и RandomizedSearchCV	What are the two methods of automatic hyperparameter guessing implemented in scikit-learn	OPK-1
162	GridSearchCV iterates over all combinations, and RandomizedSearchCV iterates over random subsets	What is the difference between GridSearchCV and RandomizedSearchCV?	OPK-1
163	Cross-validation is used to assess the quality of the model at different hyperparameter values	How are hyperparameter selection and cross-validation related?	OPK-1
164	D) Model quality based on validation data	What is the basis for choosing the optimal set of	OPK-1

		hyperparameters? A) Minimum features B) Learning speed C) Level of retraining D) Quality of the model based on validation data	
165	Retraining is possible if the parameters are selected according to the test sample	Can Hyperparameter Matching Lead to Overfitting? Explain	OPK-1
166	A) Selected before the start of model training	When are hyperparameters tuned? A) Before model training B) After training C) During prediction D) When data is normalized	OPK-1
167	Hyperparameter selection helps improve the generalizability of the model	How does proper hyperparameter tuning affect model quality?	OPK-1
168	Yes, especially when using limited compute resources and large parameter spaces	Does it make sense to use RandomizedSearchCV instead of GridSearchCV? Justify	OPK-1

2. Description of the rating scale

Students' progress in each discipline is assessed during current control and intermediate certification.

3. Criteria for assessing competencies*

3.1. Assessment of the competence of the OPK-1

The OPK-1 competence is aimed at mastering the basic concepts, theoretical approaches and tasks related to artificial intelligence and machine learning. Its formation begins with the first classes and is supported by the completion of tests, oral surveys, mini-essays and analytical tasks.

Criteria for achieving OPK-1 include:

- knowledge of key concepts: model, algorithm, feature, prediction;
- Understanding the structure and lifecycle stages of a machine learning project.
- the ability to classify tasks by type of learning;
- awareness of the differences between traditional programming and AI methods;
- knowledge of the history of development and areas of application of artificial intelligence;
- ability to analyze the conceptual foundations of modern approaches in AI and ML;
- interpretation of the role of AI in the professional and social environment.

Evaluation is carried out through theoretical questions, discussions, tasks for analysis, tasks for comparing concepts, defense of analytical works.

- ability to perform data preprocessing, scaling, feature coding;
- knowledge of the principles of building models: linear and logistic regression, decision trees, nearest neighbors method, support vector method, ensemble models;
- the ability to assess the quality of models by metrics: accuracy, precision, recall, F1, ROC-AUC and others;
- application of methods to combat overtraining: regularization, cross-validation, feature selection;
- implementation of dimensionality reduction methods (PCA, t-SNE) and data visualization;
- use of clustering algorithms (KMeans, hierarchical clustering);
- skill in tuning model hyperparameters using GridSearchCV and RandomizedSearchCV;
- ability to interpret learning outcomes, tune and optimize models;
- knowledge of the basics of stochastic gradient descent and its parameters;
- Knowledge of Jupyter Notebook, Google Colab, pandas, numpy, matplotlib, scikit-learn libraries.

Competence is assessed through the completion of standard practical tasks, error analysis, testing, mini-projects and report defense.

3.3. Assessment of the level of formation

The level of achievement of competencies is assessed on a four-point scale:

- **2 (low)** — competence is not formed, actions are fragmentary or incorrect;
- **3 (sufficient)** – competence is formed at a basic level, there are inaccuracies;
- **4 (good)** – confident application of knowledge and skills, minor mistakes made;
- **5 (high)** — competence is fully formed, decisions are justified, and the results are stable.

The competencies of OPK-1 are developed in close bundle, providing training for students to solve real problems in the field of data analysis and intelligent technologies.