2024

BRICS SKILLS COMPETITION

(BRICS FUTURE SKILLS & TECHNOLOGY CHALLENGE)

Data Analysis and Visualization

BRICS-FS-36

Technical Description

(International Final)

July, 2024

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1 Introduction

1.1 Competition Name and Description

1.1.1 The Relevance and Importance of this Document

2024 BRICS Skills Competition (BRICS Future Skills Challenge) Data Analysis and Visualization. Code: BRICS-FS-36.

1.1.2 Competition Description

The 2024 BRICS Vocational Skills Competition's Data Analysis and Visualization category is a comprehensive contest designed to encompass the entire workflow from data processing and analysis to visualization and application. Participants are required to demonstrate the ability to precisely process data, conduct thorough analyses, clearly present their findings, and efficiently develop data-driven applications. By thoroughly mastering data management and operation, this competition aims to enhance participants' skills in data analysis, visualization, and application development. These skills are intended to improve decision-making quality and operational efficiency in business settings. The Data Analysis and Visualization category is an individual competition.

Data Analysis and Visualization encompasses several aspects: data acquisition and processing, data analysis and operation, data presentation and sharing, and data development and application. Participants need to possess the following skills:

(1) Capable of using popular data analysis software to process, explore, statistically analyze, and display data.

(2) Proficient in coding to apply mathematical statistics and business data analysis techniques, calculate key statistical indicators, analyze business data,

uncover potential data value, and provide insights and recommendations with significant decision-support implications.

(3) Skilled in effectively utilizing visualization technology with BI tools to visualize and interactively explore data, communicating data analysis results clearly and effectively.

(4) Adept at using data application development tools to efficiently process and interactively present data, fostering deep exploration and comprehensive analysis through clear and intuitive data presentation methods, thereby offering robust support for business decision-making and innovation.

1.2 The relevance and importance of this document

This document contains the standards required for this skills competition, as well as information on the evaluation principles, methods, and procedures for managing the competition.

Every expert and participant must understand and comprehend this technical specification.

In case of any conflicts between the technical specifications in different languages, the English version shall prevail.

2 Skill Standards

2.1 General Description of Skill Standards

The skill standards define the knowledge, understanding, and specific skills that represent international best practices in technical and vocational performance. It reflects global consensus on what relevant job roles or professions represent in industry and enterprise.

Competitions aim to reflect the international best practices described by these skill standards and the level they can achieve. Therefore, the standard serves as a guide for the training and preparation required for competitions.

The standard is divided into different sections with titles and reference numbers. Each section is assigned a percentage of the total score to indicate its relative importance within the standard. This is commonly referred to as "weighting." The sum of all percentages totals 100. The weighting determines the distribution of scores in the scoring criteria.

Through the competition tasks, the scoring scheme only evaluates the skills listed in the standard. They will strive to reflect the standard as comprehensively as possible within the constraints of the competition.

The scoring scheme will allocate scores according to the values assigned in the standard within the practical range. A 5% variation is allowed, but it must not change the weighting allocated in the standard specification.

2.2 Skill Standards

Section		Relative Importance(%)
1	Work Organization and Management	
	Participants need to know and understand: – Systematic principles and behaviors; – System aspects of high product stability and environmental safety; – Analyzing and evaluating information obtained from various sources.	
	Participants should be able to: – Consider time constraints and deadlines; – Debug and handle errors; – Use computers or equipment and a range of software packages; – Apply research techniques and skills to keep up with the latest industry guidelines; – Plan daily production schedules according to available time; – Use English-language operating systems and software to complete English-language works as required by tasks; – Master a rich professional English vocabulary and possess English reading skills.	
2	Communication and interpersonal skills	
	Players need to know and understand: – The importance of documenting decisions; – The importance of problem-solving; – The importance of written and oral communication skills; – The importance of detailed documentation of developed solutions; – Demonstrating professionalism in document preparation.	

	Players should be able to: – Read and understand rule documents; – Follow written instructions provided in the manual; – Understand instructions and other technical documents in the workplace organization; – Interpret and understand requirements; – Understand the latest industry recommendations; – Discuss and present data; – Make suggestions and final decisions; – Use written communication skills: – Develop user documentation; – Handle English technical documents; – Write interactive reports on data analysis in Jupyter Notebook or similar environments; – Prioritize and schedule tasks; – Allocate resources between tasks.	
3	Problem-solving, innovation, creativity	
	Participants need to understand and comprehend: – Common types of issues that may arise during the development of data analysis solutions; – General types of issues that may occur in business organizations; – Diagnostic methods for problem-solving; – Industry trends and developments, including new technologies, methods, languages, conventions, and technical skills.	
	Participants should be able to: – Analyze and synthesize complex or heterogeneous information; – Define trivial and non-trivial data dependencies; – Independently query issues; – Identify and resolve issues promptly; – Properly collect and analyze information; – Develop alternative decision-making solutions, select the most appropriate options, and implement necessary solutions.	
4	Data Acquisition and Processing	25

	Players need to understand and comprehend: – Familiarity with the basic operations and common functions of analytical software; – Ability to clean and organize data; – Proficiency in the calculation functions of analytical software; – Understanding of how to create and use pivot tables and charts; – Good time management and task allocation skills; – Ability to troubleshoot and handle errors.	
	Players should be able to: – Demonstrate practical skills in data acquisition, integration, cleaning, storage, processing, and exploration; – Master knowledge of data crawling, reading and merging data from different sources, handling missing values and outliers, data exploration, as well as data saving and management.	
5	Data Analysis and Operations	25
	Players need to understand and comprehend: – Common statistical analysis indicators; – Familiarity with the basic syntax and common libraries of programming languages; – Ability to process and clean data; – Mastery of basic statistical analysis knowledge; – Familiarity with the use of data modeling and machine learning libraries; – Ability to visualize data; – Familiarity with operational data analysis methods and techniques; – Ability to optimize the data analysis process and improve code efficiency; – Ability to troubleshoot and handle errors.	
	Players should be able to: – Perform data analysis and manipulation using programming languages; – Perform operations such as data cleaning, transformation, merging, and deduplication;	

	– Apply statistical analysis knowledge to data analysis; – Understand the selection of appropriate visualization methods to clearly and effectively convey data analysis results; – Choose appropriate data analysis methods based on the situation; – Optimize the data analysis process; – Analyze and rectify errors, issues, or anomalies that may occur in the code.	
6	Data Presentation and Sharing	25
	The participants need to understand and comprehend: – Basic data processing tools and programming languages; – Basic knowledge of statistics and data analysis methods; – Understanding of visualization tools and libraries. – Ability to perform exploratory data analysis; – Understanding and application of appropriate algorithms, data structures, and optimization techniques; – Understanding of the background and relevant business knowledge in the involved field.	
	The participants should be able to: – Perform data processing and cleaning; – Calculate common statistical indicators; – Conduct descriptive statistical analysis of data; – Select appropriate types of charts, color combinations, and layouts; – Understand and interpret the results of data analysis, and propose targeted questions and suggestions.	
7	Data Development and Application	25
	The contestants need to understand and comprehend: – Basic data processing tools and programming languages; – Data structures and algorithms; – Design and implementation of single-page applications; – Graphic interface design and development;	

	– Understanding and application of appropriate algorithms, data structures, and optimization techniques; – Data processing and presentation.	
	Contestants should be able to: – Perform data processing and cleaning; – Design and develop graphic interfaces; – Build interactive elements; – Choose appropriate chart types, color combinations, and layouts; – Understand data development and application.	

3 Scoring Scheme

3.1 Scoring Methodology

The scoring for this competition will be completed online by the scoring judges. If a participant is found to be cheating or engaging in any other misconduct during the competition, the judging panel will address the infraction according to the severity of the misconduct, with severe cases resulting in disqualification.

3.2 Scoring Rules

1. Those with higher total scores rank ahead.

2. In the case of equal total scores, the ranking is determined by the order of modules D, B, C, and A, with higher module scores ranking ahead. For details of each module, please refer to section 4.2 of this document.

3.3 Evaluation Criteria

During the competition design process, the selection of criteria and evaluation methods will be determined based on the evaluation plan and competition tasks.

The evaluation criteria may include, but are not limited to:

·Quality and efficiency of data acquisition

·Technical specifications and correctness of data merging

·Methods and accuracy of data processing

·Security and compliance of data storage

·Depth and thoroughness of descriptive statistical analysis

·Accuracy and practicality of metric calculations

·Selection and innovation of data analysis methods

·Strategic application and effectiveness of data operations

·Rationality and aesthetics of graph selection

·Precision and expression of graphical data

·Flexibility and efficiency of data development

·Innovation and practicality of data application

·User experience and reliability of data application

4 Competition Topic

4.1 Common Considerations

Whether the competition involves a single module or a series of independent or interconnected modules, the topics are designed to assess the application of knowledge, skills, and behaviors as defined in the Skill Specification.

In conjunction with the scoring scheme, the purpose of the competition topics is to provide a comprehensive, balanced, and realistic opportunity for assessment and scoring in accordance with the standards. The relationship between the competition topics, the scoring scheme, and the standards will be a key indicator of quality, analogous to the relationship between the standards and actual job performance.

Competition topics do not encompass aspects beyond the defined standards, nor do they affect the balance of scoring within those standards.

The evaluation of knowledge and understanding in the competition topics is strictly based on their application in practical work.

During the operation process, relevant results must be saved promptly as required. After the competition, all equipment should remain operational, and judging will be based on the final submission.

Once the competition is completed, please leave the competition equipment, software, and topics at the workstation. It is prohibited to remove any items used during the competition (including examination papers, etc.) from the venue.

It is forbidden to make irrelevant markings on the submission materials. Violations may result in a score of zero.

4.2 Competition Topic Format/Framework

The competition topic consists of four relatively independent yet interconnected modules:

Module A: Data Acquisition and Processing

Module B: Data Analysis and Operations

Module C: Data Visualization and Sharing

Module D: Data Development and Application

4.3 Competition Topic Time Allocation and Score Weighting

Modules	Duration（min）	Score Weighting（%）
Module A: Data Acquisition and Processing	120	25
Module B: Data Analysis and Operations	120	25
Module C: Data Visualization and Sharing	120	25
Module D: Data Development and Application	120	25
Total	480	100

4.4 Module Assignment Content and Requirements

The competition covers various aspects including data acquisition and processing, data analysis and operations, data visualization and sharing, and data development and application. It comprehensively assesses participants' abilities in data analysis and visualization.

Module A: Data Acquisition and Processing: Emphasizes on data acquisition, data processing, data merging, data exploration, and data storage；

Module B: Data Analysis and Operations: Focuses on basic statistical knowledge, business data analysis methods, and data value mining；

Module C: Data Visualization and Sharing: Highlights data visualization techniques and graphical representation methods；

Module D:The assessment focuses on comprehensive implementation of data exploration, data analysis, building interactive dashboards, and data presentation.

Module Number	Module Name	Scope of Assessment
A	Data Acquisition and Processing（EXCEL）	The assessment focuses on the practical skills of participants in data acquisition, integration, cleaning, storage, and mastery of knowledge in data acquisition, handling missing and outlier values, data exploration, analysis, as well as data saving and management. The post-competition environment serves as the evaluation object to verify if the questions meet the requirements and correctly save the results.

B	Data Analysis and Operations(PYTHON)	This part of the assessment is divided into two aspects: The first aspect evaluates the mastery of participants in components related to data analysis. Commonly used statistical analysis indicators are used as the evaluation objects, and the completeness and accuracy of the indicators are the main evaluation criteria. The second aspect combines the actual data, data analysis expertise, and conducts comprehensive analysis of the specified data. It assesses participants' abilities in data operation, business knowledge, adaptability to real situations, etc. The evaluation object is the saved results, and factors such as analysis completeness, accuracy, and reasonableness of conclusions are considered comprehensively.
C	Data Presentation and Sharing(TABLEAU)	The assessment evaluates participants' ability to express analysis results reasonably. The evaluation object is the visualization product in the work, assessing

		the rationality of participants' choices of graphics and the accuracy of data representation in the graphics.
D	Data Development and Application(STREAMLIT)	The assessment examines participants' practical skills in data exploration and analysis, as well as their mastery of knowledge in data exploration, data analysis, and their application in interactive data dashboards. It tests participants' ability to use data application development tools to build interactive dashboards, ensuring comprehensive and dynamic presentation of data and the correct saving of results as required.

4.5 Publication of Sample Competition Questions

The sample competition questions will be published on the website (http://www.brskills.com/jzzy/index.html).

4.6 Revision of Competition Questions

Following review by the panel of experts, 70% of the main competition questions' topics or scope align with those in the sample questions. The official competition questions will not be disclosed to the public.

5 Skill Management and Communication

5.1 Panel of Experts

The Panel of Experts consists of the Chief Expert, Deputy Chief Expert, and Expert Members. They are responsible for collectively further revising the technical documents of this competition and managing day-to-day skill operations.

5.2 Discussion and Communication

Before the competition, if participants have any queries regarding software and hardware preparations, exam environment setup, and other logistical details, they are encouraged to provide feedback through the designated discussion and communication group. This competition includes scheduled pre-competition training sessions where the rules and regulations will be thoroughly explained, and other significant details related to the competition will be announced. Additionally, a live Q&A session will be held to address any questions related to the competition. Through these activities, participants will receive essential information and guidance to ensure that all aspects of the competition proceed smoothly.

6 Security Requirements

6.1 Organizational Structure

1. Establish a dedicated safety management organization responsible for all safety aspects during the preparation and execution of this competition, with the director of the competition's executive committee serving as the primary accountable person.

2. Develop appropriate safety management standards, procedures, and emergency response plans to ensure the safety of all aspects of the competition's preparation and implementation.

6.2 Competition Safety Management

1. Installation of competition equipment and facilities must strictly adhere to safety construction standards, with power wiring and electrical installations carried out according to regulations.

2. Fire extinguishers should be placed as per fire safety requirements, and designated individuals should be assigned to use them in case of emergencies.

3. The competition regulations should clearly state the national (or industry) safety standards, regulations, and certification requirements relevant to the occupational roles involved.

4. Prior to the competition, the executive committee of the competition will conduct safety training for all referees and staff, establish a comprehensive accident prevention system, and train competitors to prevent personal injury incidents.

5. The competition executive committee will establish a specific plan to ensure the safety of competition question formulation, custody, distribution, collection, and evaluation processes.

6. All participants must comply with health, safety, and environmental regulations.

7. Each participating country's technical representative is responsible for ensuring that their competitors and experts are briefed on the correct conduct and the health, safety, and environmental policies of the training camp before training commences, so they understand and comply with these requirements.

8. The host country's chief expert/technical expert is responsible for complying with the requirements of the competition headquarters and remote venues and providing health and safety training for experts and competitors, including adherence to sanitary and epidemiological rules, prevention recommendations for the transmission of COVID-19, and other administrative advice.

9. Each chief expert is responsible for preparing a safe working environment for themselves and their competitors, and for guiding their competitors in health and safety training.

10. All competitors are responsible for their own health and must confirm that they do not have any conditions that contraindicate participation in the competition.

6.3 Competition Environment Safety Management

1.The competition steering committee will organize dedicated personnel to inspect the competition venue, accommodation facilities, and transportation arrangements before the competition. Clear requirements regarding safety measures will be outlined. The venue layout, equipment, and facilities will comply with national safety regulations. Simulated tests will be conducted at the venue to identify potential issues, and any safety hazards will be addressed by the organizing committee according to their requirements.

2.A perimeter will be established around the venue to prevent unauthorized individuals from entering and to prevent accidents. Necessary labor protections will be provided to participants based on the requirements of relevant occupational positions. Before hazardous operations, referees will inspect and confirm equipment functionality, and during the competition, they will closely monitor to prevent errors by participants.

3.To ensure the smooth progress of the competition, the organizing college will establish corresponding security measures during the competition, which will be executed by the security, campus environment, and healthcare support teams.

(1)All vehicles and individuals entering the competition area during the competition must present credentials and willingly cooperate with staff.

(2)Before the start of the competition, participants must carefully read the "Entry Instructions" and emergency evacuation maps posted at the venue.

(3)Referees will supervise the entire process of inspecting electrical equipment before power-up to identify and rectify operational hazards promptly.

(4)Each competition device will have an independent power source to ensure safety. Participants using computers for programming must save their work promptly to prevent data loss in case of power failure.

(5)Participants must strictly adhere to safety operating procedures during the competition. In emergencies, they should immediately cut off power and evacuate under the guidance of staff.

(6)All personnel must strictly comply with venue rules and are prohibited from bringing prohibited items into the venue.

(7)Security personnel will promptly report any safety hazards to the venue's responsible personnel.

(8)Smoking is strictly prohibited in the competition venue, and security personnel are not permitted to lend their credentials to others.

(9)In case of safety issues, personnel should evacuate the scene promptly following emergency evacuation routes under the guidance of security personnel.

4.The competition steering committee, in collaboration with the organizing unit, will set up additional signage and guide personnel in areas with high pedestrian and vehicular traffic, establishing alternative routes if necessary.

5.During the competition, the organizing unit will increase personnel at critical management positions in the venue and establish a safety management log.

6.The organizing unit must remind and urge participants and competition referees to strictly avoid bringing communication devices, cameras, or recording equipment without permission. Security checks will be conducted for individuals entering important areas of the venue.

6.4 Living Conditions Guarantee

1. During the competition, the hosting organization will arrange accommodation and meals for the participants and their coaches. The host must respect the religious beliefs and cultural customs of the participants and, in accordance with national policies, ensure appropriate lodging and dining arrangements for competitors and their coaches.

2. The accommodations provided during the competition must have valid hotel and lodging business licenses.

3. The competition executive committee is responsible for the traffic safety of organized tours and observational activities during the event. Both the competition executive committee and the hosting organization must ensure the transportation safety of competitors, coaches, judges, and staff throughout the competition.

4. Apart from necessary safety isolation measures, strict adherence to national laws and regulations is required to protect personal privacy and individual freedom.

6.5 Responsibilities of Participating Teams

1. Each participating unit must arrange for the purchase of personal accident insurance for participating players during the competition period.

2. After the formation of each unit's participating team, relevant management systems must be established, and safety education must be provided to all participating players and guiding teachers.

3. Each participating team must strengthen the safety management of participating personnel and coordinate with the venue's safety management.

4. If participating teams have vehicles, they must enter and exit the competition venue with credentials issued by the competition steering committee. Vehicles must travel along designated routes and park at designated locations.

6.6 Emergency Response

In the event of an accident during the competition, the discoverer should immediately report it to the competition steering committee and take measures to prevent the situation from escalating. The competition steering committee should promptly activate the emergency response plan to resolve the situation. Competitions with significant safety issues will be decided by the competition zone's steering committee whether to suspend the competition. Afterwards, the competition zone's steering committee should provide a detailed report on the situation.

6.7 Punitive Measures

1.If a major safety accident occurs in a competition, the organizing unit's qualification to host competitions will be revoked.

2.If a major safety accident is caused by a participating team, their eligibility for awards will be revoked.

3.If a participating team has significant safety hazards and fails to address them despite warnings from venue staff, their eligibility to continue competing will be revoked.

4.Any violations by competition staff will be dealt with according to the relevant regulations. If the violations are severe and lead to major safety accidents, legal action will be taken by judicial authorities.

7 Materials and Equipment

7.1 List of Infrastructure

The infrastructure checklist provides a detailed list of all equipment and facilities that the organizing party needs to prepare. Please refer to the "2024 BRICS National Vocational Skills Competition Online Competition Data Analysis and Visualization Infrastructure " for details.

7.2 Toolkit for Competing Participants

All necessary tools will be provided for the participants. Each participant's workstation must be equipped with:

·A personal computer featuring two 2K monitors, a microphone, and headphones (or external speakers);

·Peripheral devices such as a keyboard and mouse;

·A web camera with a minimum resolution of 720p HD;

·The latest version of Google Chrome installed on the PC;

·An internet connection with a minimum speed of 50 Mbps and latency not exceeding 200 milliseconds;

The software requirements for the personal computers are as follows:

Serial No.	Name	Specification
1	Operating System	Windows, MacOS, Linux
2	BRICS Competition Client	1.0.0 or above

3	Google Chrome	99.0.4844.84 or above
4	Tencent Meeting	3.6.2 or above
5	Zoom Meeting	5.14.6or above
6	Foxit Reader	11.1.126.51346 or above
7	Office	2019 or above

7.3 Competition Equipment Inventory

7.3.1 Technical Platform

Serial Number	Platform Name	Quantity
1	Online Competition Cloud Computing Platform	1

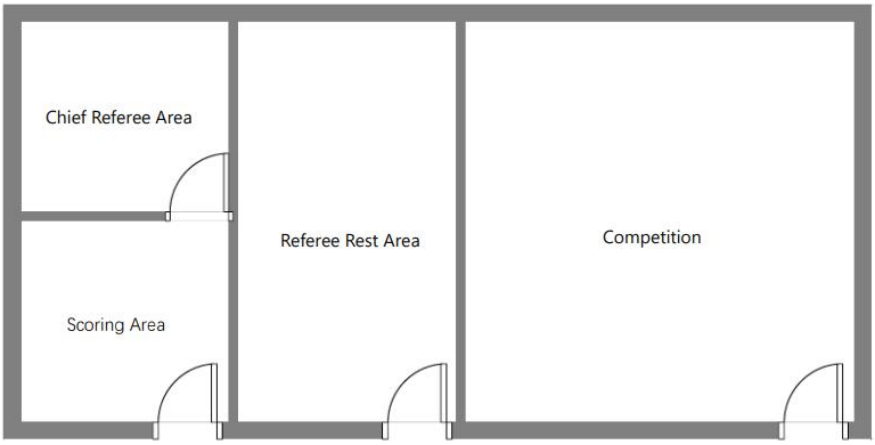
7.3.2 Specifications and Parameters

Serial Number	Name	Specifications and Parameters
1	Data Processing and Analysis Software	Excel 2019 or Above
2	Data Visualization Software	Tableau 2022.1 or Above
3	Development Language	Python 3.10 or Above

7.4 Materials and equipment prohibited for use within the skill area

Participants must declare (and present) any materials and equipment they bring to the experts. Experts may prohibit the use of any items that are unrelated to or may give competitors an unfair advantage in performing tasks.

7.5 Recommended Competition Area and Workstation Layout



8 Skill-Specific Rules

Skill-specific rules must not contradict or take precedence over the competition rules. They will provide specific details and clear instructions on various aspects, which may vary depending on the skill competition. They include but are not limited to individual computing devices, data storage devices, internet access, work procedures, and document management and distribution.

Subject / Task	Skill-Specific Regulations
Allowed Technologies: Personal laptops, tablets, and smartphones	Experts and interpreters may use personal laptops, tablets, and smartphones. Participants are not allowed to bring personal laptops, tablets, or smartphones into the venue.
Allowed Technology - Personal Cameras	Participants, experts, and interpreters are only allowed to use personal photography and recording devices at the venue after the completion of the competition task or with the consent of the chief expert.
Internet Access	Participants are prohibited from using the internet to search for information during the competition.
Client Switching	Participants are not allowed to switch out of the competition client interface without permission from the referees during the competition.
Communication and exchange	During the competition, please ensure that you wear your headphones at all times, pay attention to the chat box with competition staff, and maintain smooth communication to

	avoid missing any critical information.
Technical Issues During Task Completion by Participants	If there are technical issues during the implementation of the competition topic (not caused by the fault of the participants), the participants will be given additional time equal to the time taken from discovering the issue to completely resolving it. If the technical issue is found to be caused by the fault of the participants, they will not be given additional time.