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# SEnDIng

**D4.2**

## DATA SCIENCE VET PROGRAMME CERTIFICATION

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## Delivery Slip

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## PROJECT SUMMARY

SEnDIng project aims to address the skills' gap of Data Scientists and Internet of Things engineers that has been identified at the ICT and other sectors (e.g. banking and energy) at which Data Science and Internet of Things have broad applications. To achieve this goal, SEnDIng will develop and deliver to the two aforementioned ICT-related occupational profiles two learning outcome-oriented modular VET programmes using innovative teaching and training delivery methodologies.

Each VET programme will be provided to employed ICT professionals into three phases that include: (a) 100 hours of on-line asynchronous training, (b) 20 hours of face-to-face training and (c) 4 months of work-based learning. A certification mechanism will be designed and used for the certification of the skills provided to the trainees of the two vocational programmes, while recommendations will be outlined for validation, certification & accreditation of provided VET programmes.

Furthermore, SEnDIng will define a reference model for the vocational skills, e-competences and qualifications of the targeted occupational profiles that will be compliant with the European eCompetence Framework (eCF) and the ESCO IT occupations, ensuring transparency, comparability and transferability between European countries.

Various dissemination activities will be performed – including the organization of one workshop at Greece, Bulgaria and Cyprus and one additional conference at Greece at the last month of the project – in order to effectively disseminate project's activities and outcomes to the target groups and all stakeholders. Finally, a set of exploitation tools will be developed, giving guides to stakeholders and especially companies and VET providers, on how they can exploit project's results.

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# 1 Introduction

The scope of the deliverable is to present the certification scheme of the Data Science VET program developed by SEnDIng. The structure of the deliverable is as follows:

- Section 2 describes the approach and methodology followed for the development of the Data Science certification.
- Section 3 describes the examination system developed by UNICERT S.A.
- Section 4 describes the SEnDIng Data Science certification procedure.
- Section 5 contains the terms of the code of conduct of the certified persons.
- Section 6 contains the terms of use of the certificate.
- Section 7 contains all the Annexes of this deliverables.

## 1.1 Scope and objectives

The main goal of this deliverable is to design the certification scheme for the Data Science VET program which will be piloted during the project. The intention of the Certification Scheme is to create a functional and scalable framework designed to certify the knowledge, skills and competences provided by the Data Science VET program. It covers the requirements for the following five (5) areas:

- Certification scheme categories
- Elements of a certification scheme
- Process requirements
- Development and review of the certification scheme
- Obligations of the participants-Code of Conduct

While working on the topic of Data Science certification, the European Qualifications Framework (EQF) recommendation and its main reference level descriptors were taken into consideration:

- **knowledge** (the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices that are related to a field of work or study),
- **skills** (the ability to apply knowledge to complete tasks and solve problems),
- **competences** (the ability to use knowledge or skills in work or study situations)

In order to achieve the main goal, the team had to accomplish the following objectives:

- **Clarity of the expected impact** on candidates in terms of knowledge, skills and competences,

- **Design of a reliable and valid assessment procedure** able to capture the essence of the knowledge, skills and competences held by an individual,
- **Aligned with the educational modules**, the examination syllabus and consequently with the examination questions, so that they can complement each other and provide maximum value for the Data Scientists' profession.
- Development of an **unbiased and reliable examination system**;
- Maintain certification **examination quality** for every examination session.

## 1.2 Audience of the document

The current deliverable serves as a roadmap of the Data Science certification mechanism, detailing the steps and the actions taken during the implementation of the certification process.

Thus, the deliverable is addressed to:

- a) the *SEnDIng project partners* who shall implement the pilot trainings,
- b) the *ICT professionals* who will participate in the training and certification activities of the project,
- c) *HEIs, VET providers and certification bodies* that could provide the certification process of other or similar training courses.

The direct beneficiaries of this deliverable include ICT professionals and more specific Data Scientists who work at the ICT sector and other sectors where the Data Science is applied (e.g., banking, assurance, energy). Another category of the project's direct beneficiaries, and respectively of this deliverable, are the enterprises that employ ICT professionals who will participate in the provided VET programs, as their employees will be provided with skills and competences that meet their needs together with labour market's needs.

## 1.3 Definitions

The definitions of the main terms used in this deliverable are the following:

**Closed format or closed-ended questions:** Multiple choice questions, where respondents are restricted to choose among any of the given multiple-choice answers are known as closed format or closed-ended questions. There is no fixed limit as to how many multiple choices should be given to the respondents.

**Multiple answer questions:** Multiple answer questions allow respondents to choose more than one answer. This type of question may be used when more than one answer is correct; respondents can select all of the correct answers.

**Open format questions or open-ended questions:** Open format questions or open-ended questions give your audience an opportunity to express their opinions in a free-

flowing manner. These questions do not have predetermined set of responses and the respondent is free to answer whatever he/she feels right.

**Hot spot images:** In a Hot Spot question, users indicate the answer by clicking a specific area of an image. A Hot Spot refers to a pre-defined range of pixel coordinates within an image that when clicked indicates a correct answer.

**Validation:** validation means a process of confirmation by an authorised body that an individual has acquired learning outcomes measured against a relevant standard and consists of the following four distinct phases: a) identification through dialogue of particular experiences of an individual, b) documentation to make visible the individual's experiences, c) a formal assessment of these experiences and d) certification of the results of the assessment which may lead to a partial or full qualification<sup>1</sup>.

**Certification:** Certification is the process of formally validating knowledge, know-how and/or skills and competences acquired by an individual, following a standard assessment procedure. Certificates or diplomas are issued by accredited awarding bodies<sup>2</sup>.

**Certificate:** In the context of Erasmus+, a document issued to a person having completed a learning activity in the field of education, training and youth, where relevant. Such document certifies the attendance and where applicable, the learning outcomes of the participant in the activity<sup>3</sup>.

**Syllabus:** (a plan showing) the subjects or books to be studied in a particular course, especially a course that leads to an exam.

**Knowledge:** the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices that is related to a field of work or study. In the context of the European Qualifications Framework, knowledge is described as theoretical and/or factual<sup>4</sup>.

**Skills:** the ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the European Qualifications Framework, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments).

**Competence:** means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development. In the context of the European Qualifications Framework, competence is described in terms of responsibility and autonomy.

**Certification scheme for persons:** Competence and other requirements, related to

<sup>1</sup>[Official Journal of the European Union, Council Recommendation of 20 December 2012 on the validation of non-formal and informal learning \(2012/C 398/01\)](#)

<sup>2</sup>[Cedefop \(2014\), Terminology of European education and training policy: a selection of 130 terms. 2nd ed. Luxembourg: Publications Office](#)

<sup>3</sup>[https://ec.europa.eu/programmes/erasmus-plus/programme-guide/annexes/annex-iii\\_en](https://ec.europa.eu/programmes/erasmus-plus/programme-guide/annexes/annex-iii_en)

<sup>4</sup>[EC, Recommendation of the European Parliament and of the Council of 23 April 2008 on the establishment of the European Qualifications Framework for lifelong learning](#)

specific categories of professionals and specialized persons, for whom the same procedures, standards and regulations apply<sup>5</sup>.

**Code of Conduct:** A code of conduct is a statement of expected behaviours of the certified person. It can contain a description of professional, ethical or behavioural norms.

## 1.4 Dependencies with other WPs and deliverables

The current deliverable constitutes the “**final phase**” in the educational value chain of the VET programs. In the chain of implementation of the SEnDIng Data Science VET program, this deliverable is directly connected with the deliverables: “D2.2 Reference model of skills, e-competences and qualifications needs of DS and IoT Engineers”, “D2.3 Vocational curricula educational modules for Data Science and Internet of Things VET program”, “D2.4 Training methodology” and “D2.5 Training monitoring and assessment methodology”.

Moreover, this deliverable complies with the requirements of “D6.1: Quality Assurance Plan” and “D6.4: Impact evaluation methodology”.

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<sup>5</sup> [Guidance for the development and recognition of certification schemes for persons conformity with ELOT EN ISO/IEC 17024 Requirements](#)

## 2 Approach and methodology

### 2.1 Definition of the labour market's need for knowledge, skills, and competences certification

According to a research conducted by *CEDEFOP* in December 2016<sup>6</sup> Information and communications technology (ICT) professionals conduct research, plan, design, write, test, provide advice and improve information technology systems, hardware, software and related concepts for specific applications. From 2005 to 2015, employment for ICT professionals grew by one third. From 2015 to 2025, about 10% growth is expected, translating into some 400.000 new jobs. Such growth may increase already heavy pressure on supply of ICT professionals. They are a shortage occupation in twenty-four EU Member States and a surplus in just one EU country. The five key skills required for ICT professionals are advanced ICT skills, problem solving, moderate ICT skills, learning and **Job-specific skills**. ICT professionals are a high-skilled occupation: in 2015, seven out of 10 people held high qualifications and about one quarter of them hold medium-level qualifications. ICT is a general-purpose technology, and so changes and disruptions in the economy can have significant influence on the future Skill demands for these professionals.

By identifying Data Science competencies required by employers in a data-driven world, economies will be equipped to educate their workforce-preparing students and workers for the yet-to-be-defined jobs of tomorrow and helping economies to fulfil their economic potential. Data Science-enabled knowledge workers will have skills not easily replaced by automation; instead, they will be better prepared to unlock the promise and potential of data and all the technologies that depend on it. We are all living in a big data, digital world. Data Science skills will soon be fundamental at all levels of the workforce – from entry-level to the C-suite. Employers across every sector are being transformed by the data economy and have growing demands for Data Science-enabled workers. Key sectors include healthcare, financial services, manufacturing, research, retail, construction, mining, agriculture, aerospace, and government.

#### 2.1.1 Target group of the certification scheme

Taking into account the project's requirements, the scheme structure will be based on "D2.2: Reference model of skills, e-competences and qualifications needs of Data Scientists and IoT Engineers", as well as, on "D2.3: Vocational curricula/educational modules for Data Science and Internet of Things VET program". The knowledge areas that will be covered by the certification are addressed to:

- Learners wishing to demonstrate an understanding of the fundamental Data Science knowledge, terminology and activities. The objective is focused on an understanding of

<sup>6</sup> [https://skillspanorama.cedefop.europa.eu/en/analytical\\_highlights/ict-professionals-skills-opportunities-and-challenges](https://skillspanorama.cedefop.europa.eu/en/analytical_highlights/ict-professionals-skills-opportunities-and-challenges)

the overall knowledge areas. The purpose is to certify that a candidate has gained knowledge of the Data science terminology and basic concepts (i.e., Data Scientist Associate).

- Experienced Data Scientists who would like to prove/improve their proficiency. The purpose is to certify that a candidate has working experience as a Data Scientist (i.e., Data Science Specialist).
- Experienced Data Scientists who would like to prove expertise in a given Data Science domain (i.e., Data Scientist Expert).

### **2.1.2 Existing research on skills, competences and qualifications required by Data Scientists**

In a generic mode the skills needed by Data Scientists cover 3 intersecting areas: statistics and mathematics, computational science and specific domain knowledge (the domain where we apply the analysis of data). There are also curricula that include management and entrepreneurship skills/topics, but the core technical structure combines those 3 areas of knowledge. The taxonomizing attempts describe 3 EU and 1 US initiatives that provide or aim at solutions for curriculum design on Data Science for different target groups and proficiency levels. Only the EDISON project provides more generic but exhaustive framework and body of knowledge covering many qualification levels and target groups. All of them follow the main principles of CEDEFOP guidelines on defining, writing and applying learning outcomes and bloom taxonomy action verbs. Many universities globally provide BSc and MSc qualification in Data Science and according our research the master's degree programs has slight dominance over the Bachelor.

## **2.2 Description of the Data Science certification scheme**

The Certified Data Scientist is an individual who has the necessary knowledge/skills to recognize Data Science problems and solve them by using well-known programming languages (like R and Python), as well as, the limits between different Data Scientist roles and applications. Moreover, this person will be able to use the Hadoop framework for processing big data. In this context he/she will be able to design and develop Machine Learning applications to solve real world problems. Also, be competent to taking some responsibility in Data Science projects involving statistical analysis and data visualization.

The components of the certification are the following:

- Definition of the skills and knowledge that the certification scheme covers
- Syllabus
  - Syllabus content (topics to be covered by the certification) aligned with every certification examination module.

- The percentage of questions from each certification examination module, that will appear on the examinations.
- Examination conditions
  - Prerequisites
  - Conditions and recommendations before and after the examination
  - Duration of the certification examination process
- Type of the certification examination
  - Definition of the number of questions and format (i.e., Multiple choice, True/false, Matching, gap filling, case study questions, etc);
  - Examination format (i.e., web-based or paper based, etc);
- Grading method
  - Definition of the number of correct answers and their grading depending on the different weights or difficulty of the question.
- Passing score
  - Definition of the passing rate
- Delivery
  - Designate the examination centres where the certification examination will be held and the certificate format (i.e., template, hardcopy or e-certificate etc).

## 2.2.1 The structure of the syllabus of the Data Science VET program

The Data Science VET program includes 6 Data Science related educational modules and 1 educational module for transversal skills. These modules are:

- 1. Introduction to Data Science (DS-EM1):** In this educational module learners will be introduced to Data Science and its application at various disciplines. The aim of the educational module is to understand the learners what is the Data Science and the various kinds of activities that a Data Scientist performs. It will teach the learners about methodologies involved in tackling data science problems and basic concepts and requirements related to information security and privacy of data. Learners will complete quizzes to apply their newly acquired skills and knowledge.
- 2. Applied machine learning (DS-EM2):** In this educational module learners will be introduced to the concepts of Machine Learning and the application of machine learning techniques and methods in various domains. The aim of the educational module is to give learners a comprehensive overview of the topic machine learning and to assist them in understating what Machine Learning is, how machine learning algorithms work and how they could utilize Machine Learning techniques in solving various real world problems. In addition, the educational module will present to learners toolkits to design and formulate machine learning methods. Learners will complete quizzes to apply their newly acquired skills and knowledge.

- 3. Python for Data Science (DS-EM3):** In this educational module learners will be introduced to Python for solving Data Science problems. The aim of the educational module is to get the learners a detailed knowledge of Python tools and libraries for big data analysis, data visualization and machine learning. It will present to the learners the fundamentals of Python programming language, the NumPy package and the Pandas, Matplotlib and Scikit-Learn libraries. Learners will complete quizzes to apply their newly acquired skills and knowledge.
- 4. Storing and retrieving data (DS-EM4):** In this educational module learners will be introduced to the Hadoop ecosystem and its application at storing and processing large volumes of data distributed across commodity servers. Learners will be equipped with the theoretical and practical background needed to perform Hadoop routine tasks and troubleshoot Hadoop clusters. Learners will complete self-assessment quizzes and hands-on activities, thus applying their newly acquired skills and knowledge. Completing this EM, learners will be able to administrate and establish a secure Hadoop environment and work with the common Hadoop-related processing frameworks and modules.
- 5. Statistics for Data Science (DS-EM5):** In this educational module, learners will be introduced to R and its use for solving Data Science problems. The aim of the educational module is to get the learners a detailed knowledge of R programming language and its libraries and packages for inferential statistical analysis, visualization and machine learning algorithms.
- 6. Data Visualization (DS-EM6):** In this educational module learners will be introduced to Data Visualization (DV) and its application at various disciplines in order to enhance visual communication. Learners will be equipped with the theoretical and practical tools needed to build effective and engaging data visualizations. Learners will complete self-assessment quizzes and implement projects, thus applying their newly acquired skills and knowledge. Additionally, the role of the Data Scientist from a data presentation and communication perspective will be defined. Completing this EM, learners will be able to design and develop visual stories with data, discover trends and patterns, and potentially communicate their findings to a non-technical or a broader audience.
- 7. Transversal Skills (TS):** As part of SEnDIng vocational training, we have developed training material for the upskilling of ICT professionals at transversal skills. The aim of this training material is two-fold: (a) to help prospective learners to build their transversal skills that are developed upon academic and experiential learning and (b) to prepare them for engaging within the business environment in a creative way, communicating effectively with the internal and external environment of a business and acting in a collaborative way.

## 2.2.2 Description of the Data Science knowledge, skills, and competences to be certified

### 1. Data Science

#### Knowledge

- Describe the key concepts of Data Science
- Describe ICT methods and tools applicable for the storage and retrieval of data
- Describe methods and tools applicable for the statistical analysis of data
- Explain basic concepts and requirements related to information security and privacy

#### Skills

- Analyse domain specific trends and present them as structured information;
- Create code to statistically analyse data
- Apply data statistics and data visualisation
- Deploy simple machine learning techniques
- Deploy data storage and retrieval techniques
- Implement data models validation techniques
- Ensure that IPR, security and privacy issues are respected

#### Competences

- Exercise self-management within the guidelines of work or study contexts that are usually predictable, but are still a subject to change
- Supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities

### 2. Transversal Skills

- Communication skills
- Adaptable to change
- Teamwork
- Ability to present in front of colleagues and clients
- Goal-oriented
- Thinking outside the box
- Agile mindset

## 2.3 Certification criteria and prerequisites

The table below presents the prerequisites for participation in the pilot Data Science training programme.

Diplomas	Work experience in the field of ICT (in years)			
	0	>=1	>=2	>=3
General Upper Secondary Education				✓
Vocational Upper Secondary School or Post-Secondary Education (both in ICT fields)				✓
Bachelor in the field of ICT from a Higher Educational Institute		✓		
Bachelor in the field of engineering (other than ICT), physical sciences, life sciences, mathematics, financials and business administration from a Higher Educational Institute			✓	
Post-graduate degree (MSc and/or Phd) in the field of ICT from a Higher Educational Institute	✓			
Post-graduate degree (MSc and/or Phd) in the field of engineering (other than ICT), physical sciences, life sciences, mathematics, financials and business administration from a Higher Educational Institute		✓		

**Table 1: Prerequisites for participation in the pilot Data Science training program**

The level of knowledge is evidenced by the diplomas demonstrated in the aforementioned table, while that of the work experience by tax or insurance data, accompanied by an appropriate employer's declaration or an employer's recommendation letter mentioning the participant's relevant job description and the period of the assignment. These documents will be asked during the applicants' expression of interest for participation in the pilot programme.

**Only those who will have successfully completed the three phases of the training programme (online Data Science courses, transversal skills training and work-based learning) will be eligible to participate in the final exams leading to certification.**

Other potential prerequisites to take into consideration are the following:

1. Age: As for the age criterion we think that probably it is not necessary (i.e., more than 18 years old), since the professionals normally are older (at least the ones with the work experience that we demand).
2. Physical ability: A prerequisite for their physical abilities (i.e., without disabilities), probably it is not necessary. If all partners agree, we could request from the participants a declaration where they will certify that "the specific needs of the participant do not interfere in the training and work-based learning of the program or the assessment procedure during the certification examination process".

## 2.4 Specifications of the assessment method

### 2.4.1 Types of the examination questions

The Data Science certification exam lasts forty-five (45) minutes and is composed of twenty-eight (28) questions, which are distinguished based on their degree of difficulty in easy (50%), moderate (25%) and difficult (25%). All questions are of "closed type". For example:

- select one correct answer out of many given answers (selection of a correct choice by many)
- select the correct answers (at least two) from the given answers (selection of many correct answers out of many questions)
- filling the answer or filling in the missing text of a sentence (filling in the blanks),
- selection of the right part or parts of an image (hot spot themes) etc.

One candidate succeeds at the exams if he/she answers correct at least 70% of the questions.

### 2.4.2 Degree of difficulty and assessment

For each close-ended question the difficulty level will be determined upon the sum of four (4) assessment parameters.

#### Assessment parameters

- Number of corresponding syllabus elements: 1, 2,  $\geq 3$
- Degree of critical thinking that is required: 1: less, 2: medium, 3: more
- Degree of popularity/commonality of used terms: 1: more, 2: medium, 3: less
- Theoretical/Practical nature of the question: 1: Theoretical, 2: Practical

#### Difficulty level of each question

- Easy: 4-5
- Moderate: 6-7
- Hard:  $\geq 8$

#### Scoring

For each correct answer, the participant will be automatically awarded by the certification examination platform one (1) point and for each wrong a zero (0) point. There is no negative score.

### 2.4.3 Total number of questions per examination

Each test will be comprised of 28 close-ended questions with the proper dispersion. The distribution of questions among the educational units is depicted at the following table. For each educational module five (5) questions will be randomly selected from a question pool.

			EDUCATIONAL MODULES/TRAINING UNITS																
Allocation of questions in an examination test			DS-EM2			DS-EM3			DS-EM4			DS-EM5			DS-EM6			Transversal skills (TS)	Total
			I	C	A	I	C	A	I	C	A	I	C	A	I	C	A		
Degree of difficulty	Easy	1	2			2	1	1	1			1	1	1	1		1	2	14
	Moderate		1		1				2				1		1			1	7
	Difficult			1		1			1		1					2		1	7
<b>Total</b>			<b>1</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>4</b>	<b>28</b>

**Table 2: Allocation of the close-ended questions in an examination test**

### 2.4.4 Questions' pool for the Data Science VET programme

The total number of close-ended questions must be at least 168 (i.e., 6 times the total number of the questions of one examination test, to ensure objectivity, transparency and randomness of the test produced for each participant), as indicated in the following table.

Allocation of questions of the questions pool			EDUCATIONAL MODULES/TRAINING UNITS															Total	
			DS-EM2			DS-EM3			DS-EM4			DS-EM5			DS-EM6			Transversal skills (TS)	
I	C	A	I	C	A	I	C	A	I	C	A	I	C	A	I	C	A		
Degree of difficulty	Easy	4	7	4	4	7	4	4	6	4	4	6	4	4	6	4	4	12	84
	Moderate	2	4	2	2	3	2	2	3	2	2	3	2	2	3	2	2	6	42
	Difficult	2	4	2	2	3	2	2	3	2	2	3	2	2	3	2	2	6	42
<b>Total</b>			<b>8</b>	<b>15</b>	<b>8</b>	<b>8</b>	<b>13</b>	<b>8</b>	<b>8</b>	<b>12</b>	<b>8</b>	<b>8</b>	<b>12</b>	<b>8</b>	<b>8</b>	<b>12</b>	<b>8</b>	<b>24</b>	<b>168</b>

**Table 3: Allocation of close-ended questions to be included in the pool**

### 3 Examination system developed by UNICERT

This section presents the examination system developed by UNICERT and approved by the Hellenic Accreditation System. The **e-CERTify** online proctoring system developed by UNICERT provides a unique option to those who wish to certify their knowledge and skills through remote examinations. e-CERTify is an integrated system designed to implement distance monitoring of exams for persons certification. The relevant process takes place in an easy-to-use, but completely safe environment both for UNICERT and the candidate, ensuring the exam's reliability and transparency at the same time.

With online proctoring, the exam is carried out remotely at the candidate's workspace with the use of his own personal computer, which should have internet access and video and sound equipment (i.e., web-camera, microphone, speakers).

#### 3.1 Technical requirements for participation in the certification exams

The technical requirements for participation in the certification exams supported by the e-CERTify online proctoring system are the following:

- General Requirements
  - An Internet connection – broadband wired or wireless (3G or 4G/ LTE)
  - Speakers and a microphone – built-in or USB plug-in or wireless Bluetooth (headsets are not allowed)
  - A webcam or HD webcam - built-in or USB plug-in
  - An Email Account
- Supported Operating Systems
  - Windows 7 or higher. For devices running Windows 10, they must run Windows 10 Home, Pro, or Enterprise. Safe Mode is not supported.
  - MacOS 10.7 or higher
- Supported Browsers
  - Windows: IE 11+, Edge 12+, Firefox 27+, Chrome 30+
  - Mac: Safari 7+, Firefox 27+, Chrome 30+
  - Linux: Firefox 27+, Chrome 30+
- Processor and RAM requirements
  - Processor: Single Core 1Ghz or Higher (Minimum) or Dual Core 2Ghz or Higher Intel i3/i5/i7 or AMD equivalent (Recommended)
  - RAM: 4 GB
- Internet connection
  - 1000kbps (up/down) for high quality video
  - 1.2 Mbps (up/down) for 720p HD video
  - Receiving 1080p HD video requires 1.8 Mbps (up/down)
  - Sending 1080p HD video requires 1.8 Mbps (up/down)

## 3.2 Required actions before the exam date

### **e-CERTify special Browser Installation**

Before you take the exam, you need to install a special Browser. This includes 2 steps:

#### **Step 1: Install Mozilla Firefox**

if you haven't already, by visiting the following link:

<https://www.mozilla.org/el/firefox/new/>

#### **Step2: Install e-Certify special Browser**

Prior to the exam date, an email will be sent to you, including:

- A link for downloading and installing a special Browser;
- An attached file of settings specific for the exam.

Install the Browser (a), and then double click the attached file (b), so that the exam settings take effect.

#### **Checks to be done before the exam**

- A valid Government issued Identification Document should be available, such as a national ID card, passport, driving license, military card or social security card (including a photograph and date of birth in English characters);
- Virtualization software such as VMware or Virtual Box must be disabled. For exam security reasons, the e-CERTify special Browser cannot run through any virtualization software;
- You can rotate your webcam 360 degrees;
- You are the only person in the room throughout the exam session;
- There is no background noise in the room;
- There is adequate light in the room, but no direct light towards the web camera;
- There are no papers, books or notes on the desk;
- Your computer sound settings are set to Speakers and Microphone since headsets are not allowed during the examination;
- Mobile phones should be set to silent and not deactivated, so that contact is feasible in case of technical issues.

**Note:** *The exact Date and Time of the Exam has been communicated and agreed with the candidate.*

### 3.3 Required actions during the exam date

#### **Check-In**

##### **Step 1: Link for online Conferencing and Credentials**

On the Exam date and 30 minutes before the time of the Exam, an email will be sent to you, including:

- a) A link for online Conferencing
- b) The Exam Credentials (i.e., candidate ID and Password)

Follow the link, save and run the online Conferencing application.

##### **Step 2: Log in to the online Conferencing application**

By running the online Conferencing application, you are also logging in a waiting room.

##### **Step 3: Candidate Verification**

The invigilator needs to verify your ID before you begin the exam. With the use of the Conferencing application and the webcam, the invigilator verifies the ID of the Candidate.

##### **Step 4: Check of Video and Audio settings**

➢ Your computer sound settings are set to Speakers and Microphone since headsets are not allowed during the examination.

##### **Step 5: Check of the Candidate's workspace**

- You are the only person in the room throughout the exam session;
- There is no background noise in the room;
- There is adequate light in the room, but no direct light towards the web camera;
- There are no papers, books or notes on the desk.

##### **Step 6: Waiting the other Candidates**

Please, wait until all others in your exams session are checked-in.

#### **Exam Period**

##### **Step 1: Run the e-CERTify special Browser**

By running the previously installed special Browser, you are invited to sign in the Exams platform. Now it's the time to use the Exam Credentials you have received (i.e. candidate ID and Password).

*Note: From now on and until the end of the Exam, your computer is locked down. No application can run except the Exam, and no keyboard shortcuts and keys are available except those the Exam Administrator allows for the appropriate running of the Exam.*

## Step 2: Take the Exam

During the Exam:

- The invigilator monitors your movements
- The invigilator can see the candidates, but the candidate cannot see him/her
- Both candidates and the invigilator are muted
- Requests from the candidates to the invigilator are communicated through chatting
- If necessary, the invigilator makes appropriate announcements
- The 2<sup>nd</sup> warning from the invigilator to the candidate cancels the exams for the specific candidate.

### **Check-Out**

- When you have completed your exam, click End Exam.
- Your answers are automatically submitted, and no changes can be made.
- The invigilator confirms the end of the Exam and that the Exam session has successfully completed.

### **Additional Information**

- One (1) invigilator monitors six (6) Candidates
- In case that the Candidate does not sit for the exam for some reason (e.g., sickness), the exam is cancelled for the specific Candidate
- The candidate is not allowed to take any breaks during the Exam
- Technical problems on behalf of UNICERT cause the cancellation of the Exam. While technical failure on behalf of the Candidate cancels the Exam for the specific Candidate

### **Anti-Cheating Issues**

During the check-In process, Candidates are required to provide documentary proof of identity. The invigilator takes a few minutes for the verification, after which the Candidate is required to physically scan/turn the camera around the entire room so that the invigilator is able to examine the room for possible sources of information. Books, notepads, various digital devices, notes on the wall, papers, pens, and other items — including a second computer monitor — are not allowed in the testing environment.

The webcam technology makes it possible for the invigilator to keep watch on both the Exam taker and her/ his workspace during the Exam. The invigilator monitors the candidate continuously throughout the whole Exam process and can ask the Candidate for an additional camera scanning in case of any suspicious activity comes to mind. The invigilators are well trained and experienced to detect any hints of malpractice related to Candidate's eye movement and body language. In case that something suspicious is detected, the Candidate is warned once. In case of a second warning, the Candidate is disqualified and the Exam is terminated for him/her.

### 3.4 Human Resources requirements

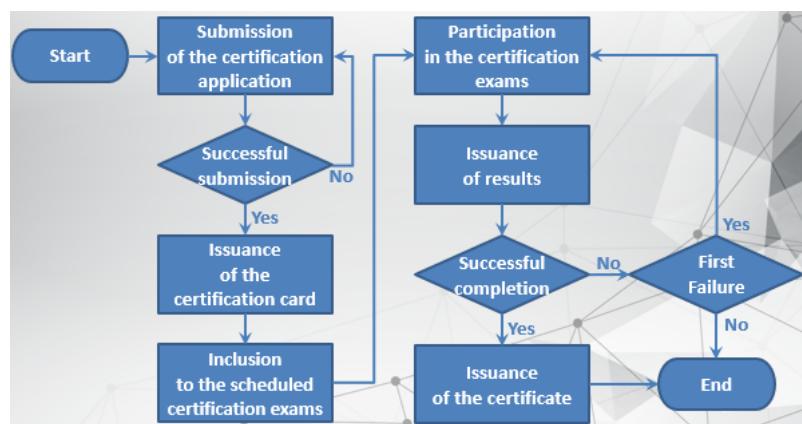
UNICERT S.A. ensures that Certification Examiners are suitably qualified and have received the necessary training to enable them to carry out the supervision of the certification examinations (including tele-examinations) in accordance with the requirements of UNICERT S.A. The examiners sign a relevant form of acceptance of conditions for compliance with the standards of supervision, confidentiality and impartiality required by UNICERT S.A. At the start of cooperation with each new supervisor, an update (Quality Protocol-22) is provided for:

- the Quality Management System implemented by UNICERT S.A.,
- the certification examination procedures followed,
- all other procedures relating to his employment, and
- Possibility to attend a supervision as a trainee in order to follow the process closely, before undertaking a supervision on his own.

## 4 SEnDIng Data Science certification procedure

### 4.1 Certification steps

The SEnDIng Data Science certification procedure includes the participation in one examination and in case of failure, participation in two (2) reassessments. Upon completion of the certification exams (examination and retest), a list of participants in the certification exams will be issued, which will record the results of the examinations. For those who have succeeded in the exams, a decision will be taken to issue their certificates. In detail, the certification path consists of the following steps:



**Figure 1: SEnDIng certification steps**

**Step 1.** Submission of the certification application and the necessary supporting documents for each candidate.

**Step 2.** Verification of the Application for Certification and its supporting documents for each candidate.

**Step 3.** If the application is approved, issuance of the Skills Card for each candidate, otherwise resubmission of the correct application and/or supporting documents (repeating steps 1 and 2).

**Step 4.** Inclusion of the candidates to the scheduled certification exams.

**Step 5.** Participation of candidates in the certification exams.

**Step 6.** Immediate issuance of results at the end of the examination process. For those who did not successfully complete part of the modules of the certification exams or the whole examination there can be two (2) repetitions of steps 4 to 6.

**Step 7.** Issuance of a decision to grant certificates to those who have successfully passed the certification exams.

## 4.2 Submission of the certification application

Those interested to participate in SEnDIng certification exams have to fill in the online form <https://unicert.gr/european-project-en/?lang=en> with the following data:

- Personal Data
  - First Name, Last Name, Father's name, Mother's name
  - Identity number (identification card (ID) / Passport / Other)
  - Gender (Male/Female)
  - Full address (Street / Number / Area / P.C / City)
  - Landline Number
  - Mobile phone number
  - E-mail address
  - Country
  - Occupation
- Special needs
- Supporting documents
  - Photocopy of ID document
  - Photocopy of graduation certificate from an educational institution (at least of Compulsory Education)
- Preferable date for participation in exams

## 4.3 Verification of the certification application and its supporting documents

The review of the application focuses on:

- Check of the completion of the mandatory fields.
- Identification of application details and documents / supporting documents submitted.
- Existence of a handwritten signature.
- Existence of other evidence (what is required by the certification).
- Check for previous entries in the examinations.
- Check for earlier misuse of the certificate by the applicant; in this case, the application is considered rejected.
- Acceptance of the terms of personal data management.
- Applicant's agreement on the terms of Certification.

## 4.4 Certification Exams Schedule

The candidates will be informed for the date of conduct of the certification examinations carried out at least 15 days prior to the completion of the certification. The information will be communicated to the applicants with reference to:

- The examination centre info (email, contact phone number, contact person);
- The date and exact time of conduct of the examination;
- Information for persons with disabilities;
- Anything else considered necessary.

## 4.5 Participation of candidates in the certification exams

As we have mentioned at Section 2, the examination process will last 45 minutes and will consist of 28 closed-ended type questions, which will be distinguished by the degree of difficulty in easy (50%), moderate (25%) and difficult (25%). The examinees will be able to:

- choose one answer that they consider correct from a series of possible answers (multiple choice)
- select from the given answers (at least two) that are correct (multiple choice)

A candidate succeeds at the examination if he/she answers correctly at least 70% of questions (20 correct answers out of the total 28). In this case and after the necessary checks, the corresponding certificate is also issued. During the period of each examination, candidates must meet the requirements of their subjects, having as well the chance to check their responses and make possible corrections before confirming completion. In case of retaking the exam due to failure in a certification subject, the examination platform will ensure that the same set of exam questions is not displayed.

### 4.5.1 Steps during the examination process

The test will be conducted on a digital exam platform specially designed for the certification/examination tasks of the project and according to the quality assurance procedures of UNICERT S.A. Moreover, the online proctoring system of UNICERT presented at Section 3 will be used:

The steps taken are the following:

1. Start the exam application.
2. Enter the exam code to the corresponding field.
3. Introduce the unique Unicert Supervisor Code and the Supervisor from the Registry of Auditors-Supervisors-Auditors-Inspectors-Experts of EOPEPEP, on each computer.

Then the details of an examiner who is invited to come to the computer screen are displayed. This action is repeated on each computer for each supervised exam period.

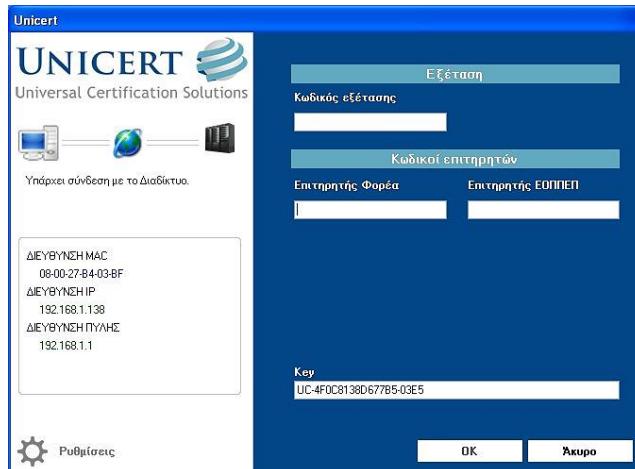


Figure 2: Certification exams platform for SEnDIng project (1/2)

4. Give to the candidates their username and password in order to enter the corresponding field.

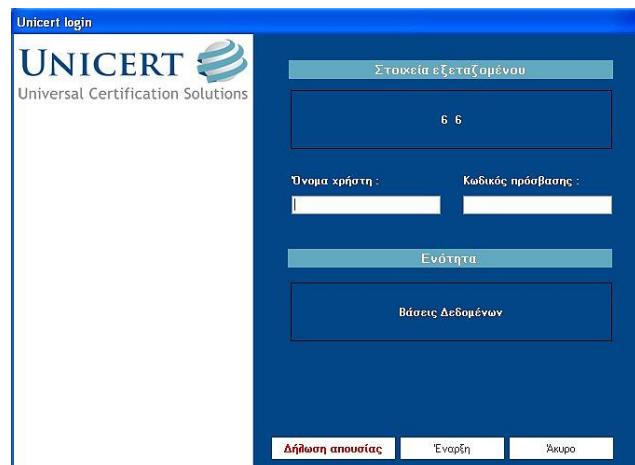


Figure 3: Certification exams platform for SEnDIng project (2/2)

5. In case of an absence of a candidate the supervisor enters his code in order to confirm the absence. If the test does not start and the start time has elapsed, the absence is automatically declared in the system.

NOTE: A prerequisite for starting the exam is to have an Internet connection to download the exam questions.

6. The exam form appears at the bottom of the screen at the beginning of the test. Depending on the question, the application is properly adjusted. When the examiners are confident that they have responded correctly to what the text to speech is asking for, they select the Confirm button. If they want to think about it and answer it at the end, pressing the Previous and Next buttons they are redirected to other unanswered

questions. With the Reload button, the exam question returns to its original format without any action taken. Also, it is possible to increase or decrease the font size of the text, contrasting the text and background colours and the “pin” of the screen.

7. If the test is not responding, recovery is performed, and the test data is not lost. The examiner terminates the examination process (Inspector.exe) from the Task Manager and reopens the application. The test returns to where it was when the Confirm button was last pressed.
8. Quit Exit: If all the questions are answered, a successful result message is displayed. If there are unanswered queries, a table with the corresponding queries appears and there is the possibility of returning to the test. If the candidate wishes, he/she may terminate the exam at any time by clicking the end button, even if there are unanswered questions.



**Figure 4: Successful submission of answers**

**NOTE:** If an error is reported while the results are being sent, a check is made on the Internet connection. If the problem is restored, by pressing OK the results are successfully sent. If it is not restored, it is important to type the exam code and the supervisors' code and then save the encrypted file to the user's selection folder (desktop is recommended). Then, through the "Settings" and the tab "Examination System", in the "Send Results" field, the user selects the "From file" choice and he/she searches the encrypted file that has been saved. Another option is to send it with a code, always in consultation with the responsible of the examinations.

1. As soon as the results are successfully sent, the second examination session may start by repeating the procedure with steps 1-4.
2. At the end of all the examination periods/sessions, the following actions take place:
  - a. Verification that all candidates have simultaneously stopped the examination process by announcing the end of the exams.
  - b. Optional completion of the applicant satisfaction survey questionnaire, which is anonymous.
  - c. The Supervisors shall confirm that all the examinations have been taken.
  - d. Completion of the Certification Examination Report by the supervisors.

## 4.6 Assessment of the results

The assessment of the results/performance of the candidates will be performed automatically by the on-line examination system/platform. At the end of each examination test there will be possible to receive from the central test server encrypted electronic files with the results of the evaluation carried out over the Internet.

## 4.7 Delivery of a certificate

This task requires the successful participation in the certification exams, according to the defined success threshold (70%). The partner that is responsible for the certification tasks will issue the certificates in digital and/or hard copy (following the agreed template as cited in the Annexes of the current deliverable) and send them by mail to the successful candidates.

## 5 Code of conduct of the certified persons

### 5.1 Participants' obligations

In order to participate in the certification examination, the participants have certain obligations until the end of the examination process. These obligations are included in the term code of conduct which has been carefully set as a series of commonly followed rules. More specifically:

- Connected to the examination system: at least thirty (30) minutes before the beginning of the certification exam. After the beginning of the examination the entry of candidates in the examination system will not be allowed.
- Necessary documents for the participation of each candidate in the examination:
  - The certification card and
  - The original identification document and a copy of it, which was submitted with the certification application.
- Items allowed in the surround space: thermos / bottle of water or soda.
- Items forbidden in the examination procedure:
  - Any type of electronic storage media (ie, removable USB drives) and
  - Any type of external image capture devices / audio / video (ie, cameras). It should be noted that, upon approval by the supervisors of this examination, any type of telecommunication devices is not allowed (ie, mobile phones) in the examination space.
- Smoking is strictly forbidden during the examination. The temporary exit for smoking is forbidden for all candidates during the examination. It should be noted that before the start or between the examination of two modules.

#### During the conduct of the Certification Examination

- The behaviour of the candidate during the conduct of the examination should be determined by the known rules of discipline and respectful behaviour. Candidates must comply directly to any suggestions or recommendations of the supervisors. Failing to comply with the above, can even lead to their exclusion from the examination, which is considered unsuccessful and scored with zero (0).
- Activating and using the telecommunication devices during the examination (i.e., mobile phones) is prohibited, if they are not taken away by their supervisors, for as long as the examination lasts.
- Any attempt or actions/methods of copying answers and generally preventing the proper conduct of the examinations or alteration of their results, is prohibited and people responsible will be disqualified, their examination will be considered unsuccessful and scored with zero (0).

- During the examination candidates are not allowed to exit the examination system, without the approval of the supervisors.
- Candidates are not allowed to remain in the examination system after completing their examination.

## 5.2 Participants' rights

Each person, a candidate for certification, has the following rights:

- Submission of the certification application online via UNICERT S.A. website.
- Ability to conduct a "simulation test" prior to examination in any designated Center of the ERASMUS+ project partnership in order to familiarize yourself with the examination procedure.
- Complete control of his/her answers to the syllabus that there are going to be examined.
- Object to any matter related to the examination procedure.
- Use of the certificate issued by the organization after the successful completion of its certification, anywhere in the Private and/or Public Sector, without violation of the conditions accompanying it.

## 5.3 Participation instructions

Individuals who wish to participate in certification exams should:

1. Contact the UNICERT S.A. in order to obtain a Certification Card.
2. Submit the Certification Application Form which can be found in the following [link](#). Moreover, a scanned copy of a valid form of identification and any additional supporting documentation are required to publish the Certification Card. This card is been received by the candidates. It contains personal information, certification category, the tested modules, their performances at the exams, as well as instructions for use.
3. Be on time to login to the examination system, presenting the certification card and the original form of identification, which they had displayed. Note that in case of failure, the candidates are retested with the same card, following the steps 3 and 4.
4. Receive their Certificate within a maximum period of ten (10) working days after their successful participation in the certification exams.

Valid form of identification means:

- For Greek citizens: identity card or a temporary certificate of the competent authority, passport, driving license, personal insurance booklet.
- For citizens of the European Union: identity card, passport.

- For citizens of countries outside the European Union: visas, residence permit, work permit.

## 6 Terms of use of the certificate

1. The **Certificate of the VET program Data Science**, may be used as official proof of certified knowledge and skills only for the modules described herein, according to Certification Scheme Regulation (CSR) and its Appendix (CSR-APDX2D) that corresponds to the modules.
2. The holder of this certificate may declare and display possession of said certificate only for the modules described herein.
3. The holder of this certificate may not use it in any misleading or otherwise improper manner.
4. The holder of this certificate may not state anything with regard to this particular certification that may be construed as misleading or otherwise improper.
5. The holder of this certificate must immediately inform the partnership of the ERASMUS+ project SEnDIng of matters that can affect his/her capability to continue to fulfil the certification requirements.
6. The holder of this certificate must cease any usage or mention of said certificate immediately upon its revocation or withdrawal regardless of reason.
7. The holder of this certificate must return all documents relevant to the certificate being revoked or withdrawn, including the certificate itself, to the partnership of the ERASMUS+ project SEnDIng immediately.

## 7 References

- [1] [Official Journal of the European Union, Council Recommendation of 20 December 2012 on the validation of non-formal and informal learning \(2012/C 398/01\)](#)
- [2] [Cedefop \(2014\), Terminology of European education and training policy: a selection of 130 terms. 2nd ed. Luxembourg: Publications Office.](#)
- [3] ERASMUS+ Programme Guide, Annex III Glossary of terms, ([https://ec.europa.eu/programmes/erasmus-plus/programme-guide/annexes/annex-iii\\_en](https://ec.europa.eu/programmes/erasmus-plus/programme-guide/annexes/annex-iii_en))
- [4] [EC, Recommendation of the European Parliament and of the Council of 23 April 2008 on the establishment of the European Qualifications Framework for lifelong learning](#)
- [5] Hellenic Accreditation System, [Guidance for the development and recognition of certification schemes for persons conformity with ELOT EN ISO/IEC 17024 Requirements](#)
- [6] CEDEFOP, ICT professionals: skills opportunities and challenges, [https://skillspanorama.cedefop.europa.eu/en/analytical\\_highlights/ict-professionals-skills-opportunities-and-challenges](https://skillspanorama.cedefop.europa.eu/en/analytical_highlights/ict-professionals-skills-opportunities-and-challenges), December 2016
- [7] IBM Report (2016), [The Quant Crunch: How The Demand For Data Science Skills Is Disrupting The Job Market](#)
- [8] [Kaggle Data Science Survey 2018](#)

## 8 Annexes

The Annexes attached to the deliverable are the following:

- Annex 1: Template of SEnDIng Data Science certification
- Annex 2: User manual for online proctoring system
- Annex 3: Certification Procedures Frequently Asked Questions

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**Annex 1**  
**Template of SEnDIng Data Science certification**

# UNICERT SKILLS CERTIFICATION OF KNOWLEDGE & SKILLS

*This is to certify that:*

Name Surname:

Father's name/Mother's name:

Date \_\_\_\_\_

*Has succeeded in the examinations for the following modules:*

## *Data Science*

*(certification scheme in the frame of the ERASMUS+ project Sector Skills Alliance for the design  
and delivery of innovative VET programmes to Data Science and Internet of Things  
professionals - SEnDIng 591848-EPP-1-2017-1-EL-EPPKA2-SSA)*

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*N. Noulas*

*Legal representative of UNICERT S.A.*

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## **Annex 2**

### **User manual for online proctoring system**

## SEnDIng Project

### UNICERT Teleproctoring Exams

#### INSTRUCTIONS to Examiners

##### 1. General Requirements

- ✓ Desktop or Laptop (Windows XP or later)
- ✓ Internet connection
- ✓ Camera & Microphone & Speakers
- ✓ E-mail

##### 2. Installation of required programs

In order to complete the test, you need to install a specific test program (UNICERT Exams Client) as well as a video conferencing program (Zoom Meetings), before the scheduled date of the examination.

##### Download & Install UNICERT Exams Client & Zoom Meetings

- ✓ UNICERT Exams Client
  - Version for Windows XP or later ([download here](#))
  - If needed, download the .netFramework 4 by clicking [here](#)
  - For Windows XP, Service Pack 3 has to be installed.
- ✓ Zoom Meetings ([download here](#)).

Before the test, make sure that your microphone and speaker are working in any zoom meeting.

##### 3. Exam preparation

- ❖ Make sure that you have an identification document available, such as Identity card, Passport or Driver's License
- ❖ The camera can be rotated 360 degrees.
- ❖ There are no other persons in the area during the examination.
- ❖ There is no background noise.
- ❖ There are no papers, books, notes.
- ❖ There is sufficient lighting that does not disturb the camera.
- ❖ Speakers are allowed, but headphones are not.
- ❖ Mobile phones are muted, not switched off.



## 4. Before the examination

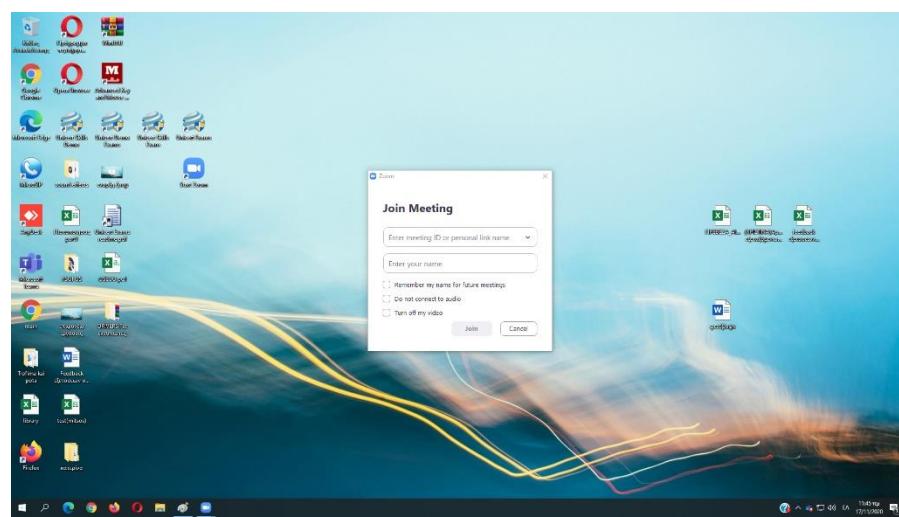
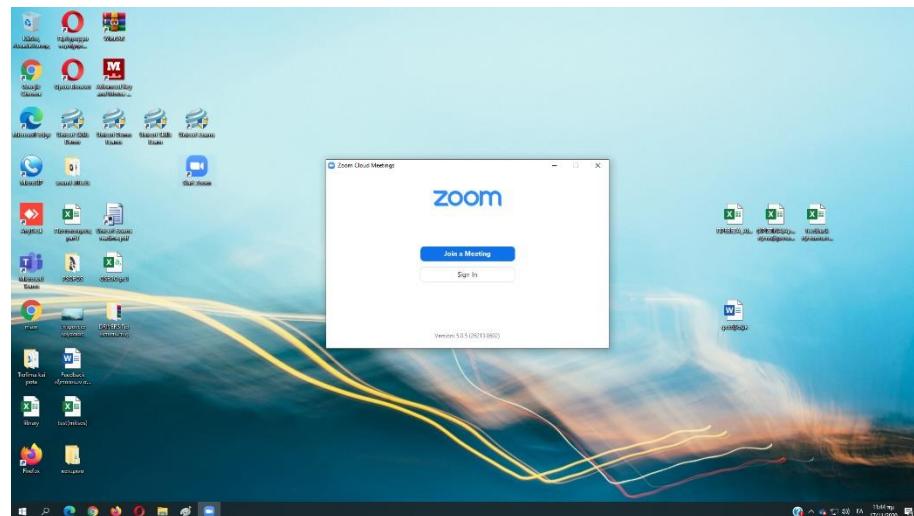
Two (2) days before the examination, you will receive an e-mail that includes:

- ✓ Link and Meeting ID for Teleproctoring written exams.
- ✓ Exam Codes (candidate ID and Password). Write down the codes, they will be needed in the next step.
- ✓ Dates and hours of written exams, respectively.

## 5. Check-In

### Starting the Zoom meeting

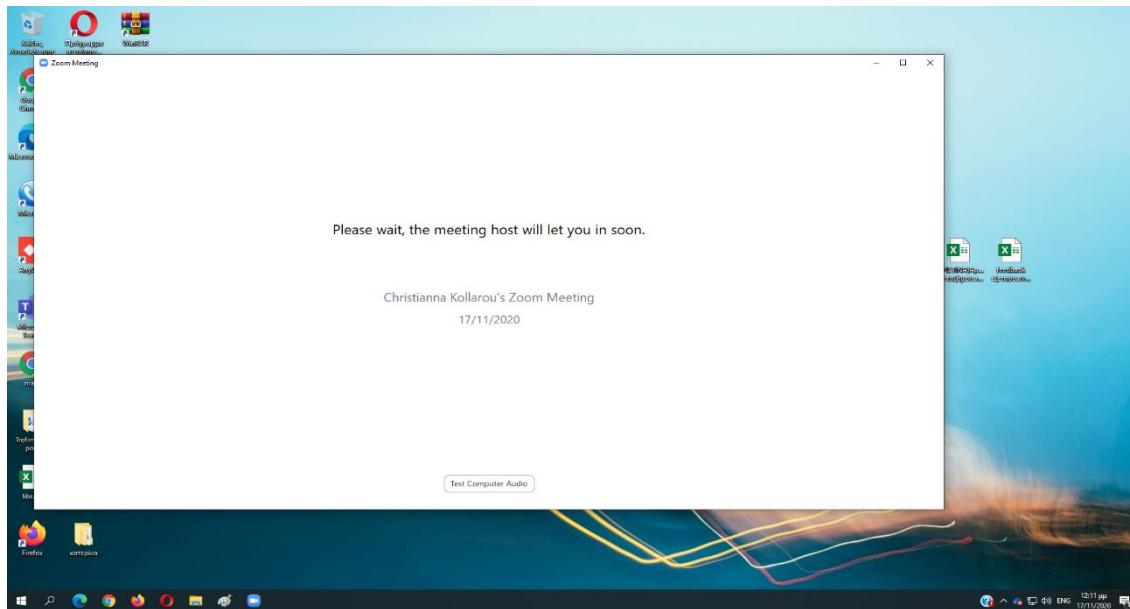
At least 30 minutes before the scheduled test time, start the Teleproctoring session. On the Zoom window, select "Join a Zoom meeting", enter the ID meeting that was sent to you via email, your name and surname, as stated in the ID document.



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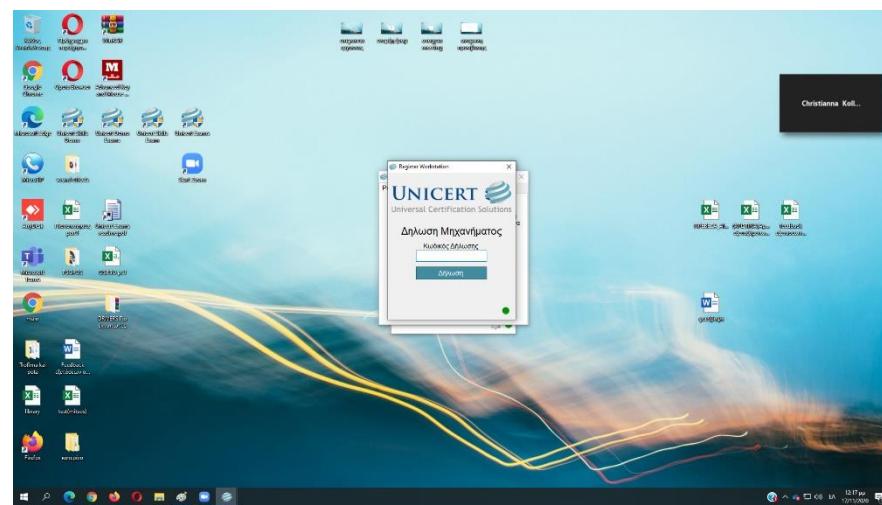
When launching the Videoconferencing application, you enter a "waiting room" and wait until the certified proctor admits you.



Once you enter the Video Conference room, the following procedures are performed:

- ✓ Picture and sound settings are checked.
- ✓ Using the camera, the certified proctor verifies your identity.
- ✓ Check of your space.
- ✓ Wait for all candidates to be admitted.

At the same time, you start the exam program, which will ask you to register your computer on the first window, in order to begin with the examination. The specific declaration code will be given by the proctor, after validating the details of all participants.



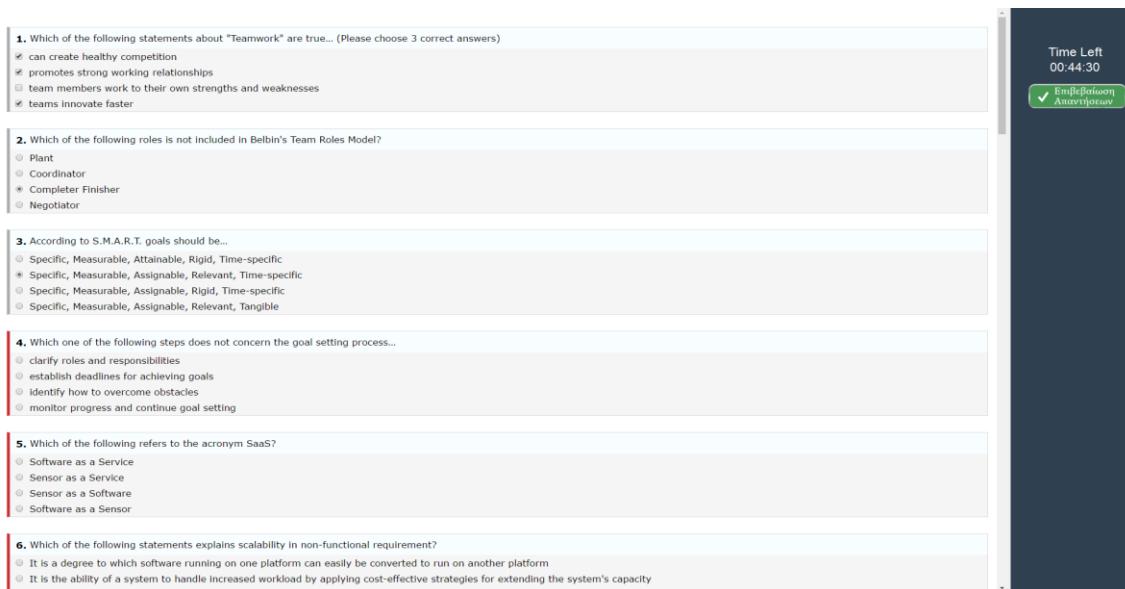
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## 6. Examination

Enter the credentials you have been given in the email you received. From this point until the end of the exam, your computer is "locked", only the exam application and the teleproctoring application are running.

During the examination, each unanswered question has a distinctive red line. If there are still unanswered questions in the submission, a pop-up dialog box will point this information to the candidate.



The screenshot shows a list of six questions from a multiple-choice exam. The sidebar on the right displays a timer set at 00:44:30 and a green checkmark next to the text "Επιβεβαιωση Αποτελέσματος".

1. Which of the following statements about "Teamwork" are true... (Please choose 3 correct answers)
  - can create healthy competition
  - promotes strong working relationships
  - team members work to their own strengths and weaknesses
  - teams innovate faster
2. Which of the following roles is not included in Belbin's Team Roles Model?
  - Plant
  - Coordinator
  - Completer Finisher
  - Negotiator
3. According to S.M.A.R.T. goals should be...
  - Specific, Measurable, Attainable, Rigid, Time-specific
  - Specific, Measurable, Assignable, Relevant, Time-specific
  - Specific, Measurable, Assignable, Rigid, Time-specific
  - Specific, Measurable, Assignable, Relevant, Tangible
4. Which one of the following steps does not concern the goal setting process...
  - clarify roles and responsibilities
  - establish deadlines for achieving goals
  - identify how to overcome obstacles
  - monitor progress and continue goal setting
5. Which of the following refers to the acronym SaaS?
  - Software as a Service
  - Sensor as a Service
  - Sensor as a Software
  - Software as a Sensor
6. Which of the following statements explains scalability in non-functional requirement?
  - It is a degree to which software running on one platform can easily be converted to run on another platform
  - It is the ability of a system to handle increased workload by applying cost-effective strategies for extending the system's capacity

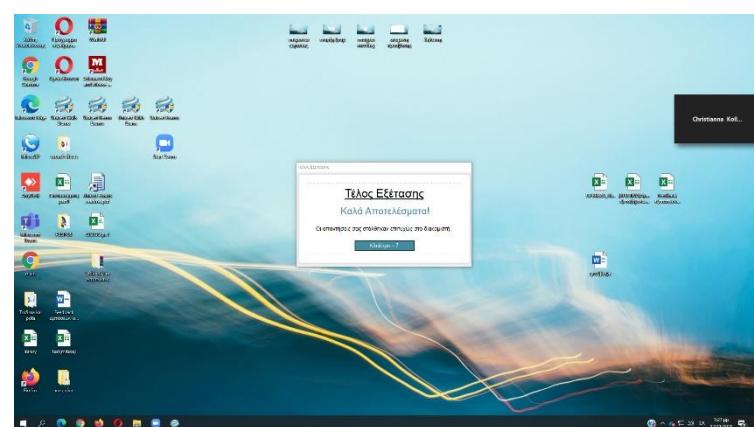
### During the examination:

- The certified proctor monitors your movements. He sees you but you don't see him.
- The proctor as well as the candidates are muted.
- When needed the proctor makes relevant announcements.
- Should the proctor warn the same candidate twice, his examination is cancelled.

## 7. Check-Out

When you have finished the exam, click on the relevant button to declare the end. Replies are submitted automatically and no changes can be made.

The Supervisor confirms the end of the Examination and the successful completion of the procedure.



**Best of luck!**

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### Annex 3

#### **Certification Procedures Frequently Asked Questions**

## Certification Procedures Frequently Asked Questions

### **Q1. When the final exams will take place?**

The final exams will take place in two rounds. The first round will be on November 2020 and the second round on December 2020. The specific dates of the exams will be defined in consultation with those expressing interest to participate in the exams.

### **Q2. How many chances I have in order to pass the final exams?**

There are 2 chances to pass the final exams. In the case that you will fail to pass the exams during the first round (on November) or the second round (on December), there will be a resit round on late December.

### **Q3. How the final exams will be delivered?**

Due to the COVID-19 outbreak, the final exams will be delivered online with eProctoring using your own personal computer.

### **Q4. Which are the requirements of the online exam?**

The minimum requirements of the online exam are the following:

- Photo ID (A valid Government issued ID that includes a photograph and date of birth in English characters, such as a National ID card, Passport, driving license or social security card.)
- A quiet room with sufficient light and a clean desk. No other persons are allowed to be present in the room.
- External or integrated Web camera able to rotate 360°
- Desktop or laptop with Internet connectivity (at least 512/512 kbps for uploading /downloading)
- Speakers and microphone

### **Q5. Which is the duration of the exam?**

The duration of the exam is 45 minutes.

### **Q6. Which topics will cover the exams?**

For those attending the Data Science training, it will cover the following modules

- DS-EM2: Applied Machine Learning
- DS-EM3: Python for Data Science
- DS-EM4: Storing and Retrieving Data
- DS-EM5: Statistics for Data Science
- DS-EM6: Data Visualization
- TS: Transversal Skills



For those attending the IoT training, it will cover the following modules

- IoT-EM2: Architectural Design and Applications in IoT
- IoT-EM3: IoT Communication Technologies
- IoT-EM4: IoT Security and Privacy
- IoT-EM5: IoT Devices
- IoT-EM6: IoT Business Value
- TS: Transversal Skills

#### Q7. Which will be the format of the exam?

The format of the exam is the following

- It will be delivered in English.
- It contains 28 multiple choice questions.
- All the questions should be answered.
- Wrong answers will not have negative impact at your score.
- The distribution of the questions among the various modules is the following

For those attending the Data Science training

Difficulty of question	DS-EM2	DS-EM3	DS-EM4	DS-EM5	DS-EM6	Transversal Skills
Easy	3	3	2	2	2	2
Moderate	1	1	2	1	1	1
Difficult	1	1	1	1	2	1
<b>Total</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>4</b>	<b>5</b>	<b>4</b>

For those attending the IoT training

Difficulty	IoT-EM2	IoT -EM3	IoT -EM4	IoT -EM5	IoT -EM6	Transversal Skills
Easy	3	3	2	2	2	2
Moderate	1	1	2	1	1	1
Difficult	1	1	1	1	2	1
<b>Total</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>4</b>	<b>5</b>	<b>4</b>

#### Q8. Which is the score that I should achieve in order to pass the final exams.

The minimum score that you should achieve in order to pass the final exams is 70% (20 correct answers out to 28)