Brochure

Matching & Selection Procedure

BSc Computer Science & Engineering

2022-2023 - Digital Route
Brochure 2b—Digital route

Matching & Selection Procedure
Please read this brochure to know what to expect when participating in the BSc Computer Science & Engineering (CSE) Matching & Selection procedure if you choose to follow the Digital route.

The deadline to apply for the CSE programme is January 15. Note that this is a fixed deadline.

If you are still considering whether this is the right study for you, please read brochure 1—On how to choose your study from the website.

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All dates and time in this brochure are in Central European Time (CET), Dutch local time.
Bachelor Computer Science & Engineering

During the bachelor Computer Science and Engineering (BSc CSE) you will learn how computers, networks and embedded systems work. You will study algorithms and address questions such as: “what is an algorithm?” and “how can you represent software mathematically?” Of course, you will also study data structures and work with various programming languages. You will learn how to model complex systems and how users interact with such systems. During this programme you study solving problems in a logical and analytical way.

Who are we looking for?

- Curious problem-solvers and profound analytical engineers
- Pro-active team workers who are able to collaborate and communicate well
- Competent learners with good planning and self-regulatory skills
- Disciplined students who are capable of handling a large amount of self-study
- Students who adhere to and identify with the TU Delft values: Diversity, Integrity, Respect, Engagement, Courage and Trust (DIRECT), as embodied in the [TU Delft Code of Conduct](#).

Digital route

The CSE Matching & Selection procedure consists of two routes: The On Campus route and the Digital route. At the start of the Matching & Selection procedure you need to choose which route you want to follow. Figure 1 on the next page shows a diagram of the two routes. If you choose the Digital route you can expect the following:

You can complete the Matching & Selection procedure fully online for the Digital route. The various steps of the procedure will use different platforms. You are responsible yourself to ensure that you have the right equipment to participate in the Digital route (for more information see page 8 of this brochure ‘Proctoring requirements’). Once you have chosen to follow the Digital route you cannot switch to the On Campus route.

Upon completion of all Matching & Selection activities you will receive a ranking number that is constructed of four components (the percentages indicate the weight of the component towards your final score):

- Mathematics (25%)
- Systematic Reasoning and Logical Thinking (25%)
- Algorithmic & Computational Thinking (25%)
- Teamwork (25%)

Extra time

Candidates who have been diagnosed with a learning disability and/or are experiencing extenuating circumstances can request extra time for the CST by contacting selection-bsc-cse@tudelft.nl Requests need to be supported with documentation (e.g. a medical or psychological statement), which is readable in English or Dutch and should be submitted before 14 February, stating your full name and student number.

[Disclaimer](#) Please keep in mind that updated information will be provided by email throughout the process.
Figure 1. Digital Route vs. On Campus Route

**Estimated time On Campus route**

1 hour choose your route  
2 hours homework (minimum)  
14 hours attending the On Campus days  
X hours travel time depending on how far away you live from the TU

**Estimated time Digital route**

1 hour choose your route  
5 hours preparation (minimum)  
2 hours Online Student Experience  
3 hours CST + 1 hour setting up  
6 hours Teamwork assignment

When you have completed all the steps in the Digital route, you will:

- Have good impression of the bachelor CSE and whether it is a suitable programme for you.  
- Know what skills and knowledge are expected from you in the next year.  
- Have worked together with fellow prospective students in an online environment.  
- Receive a ranking number on April 15.
Digital route Matching & Selection procedure in 9 steps

Step 1 - Register in Studielink before January 15

In order to apply and participate in the Matching & Selection procedure, you need to register yourself online in Studielink, the Dutch national enrolment system for higher education. Please note that it takes time to obtain a login for Studielink, to collect the required documents and to complete your application. If you have an international secondary school diploma, make sure to continue your application in the online application system of TU Delft, called Osiris and submit your complete application file by January 15. Start in time as all deadlines are fixed, as we need to comply with strict national deadlines set by the Dutch government. More information about the exact application procedure can be found on the website.

Email

Please ensure that the email address you use in the Matching & Selection procedure is the same as the email address you use for Studielink, as this will be used as your unique identifier throughout the procedure. Make sure to check your inbox and spam folder at least once a week and on a daily basis on important dates. Keep in mind that you will be kept informed through email on a regular basis about the next steps in the procedure. Note that you need access to the email address you use until the beginning of the study year.

Regulations

All rules governing the Matching & Selection procedure can be found in the Regulation Matching & Selection Criteria and Procedure, which can be downloaded from the bottom of the website.

Step 2 - Choose your route, CST date & Surveys

After the Studielink registration deadline has passed (15 Jan). The first communication for the selection programme will be by email, which you will receive on your Studielink email address and before January 22. During the whole Matching & Selection procedure you will receive instructions by email for every step.

If you choose to follow the Digital route you will be asked to deliver the following:

- Indicate on which date you prefer to take the CST*.
- Give consent that the TU Delft can share your name and email address with the other candidates you get grouped with to complete the Teamwork assignment.
- Completion of the Matching Surveys.

* There is a fixed amount of seats per CST date. If the amount of candidates exceeds the available seats for a specific day, seats will be randomly allocated among the candidates who choose this option.
Step 3 - Complete Online Student Experience (OSE)
Before **29 January** you will be invited by email to complete the Online Student Experience. You need to complete the OSE before **9 February at 23:59 CET**. The OSE is part of the Matching procedure and is meant to help you find out if CSE at TU Delft is the right study choice for you. Although the OSE will *not* be used to calculate your ranking number, completing the OSE will grant you access to the CST, so make sure to answer all questions in a meaningful way.

Step 4 - Confirmation CST date
If you have completed the OSE you will receive the confirmation of your CST date after the OSE deadline and before **18 February**. There is a fixed amount of seats per CST date. If the amount of candidates exceeds the available seats for a specific day, seats will be randomly allocated among the candidates who choose this option.

Step 5 - Test proctoring
On **22 and 23 February** you will have the opportunity to test if the proctoring software works on your computer. Please keep in mind that you are responsible yourself for assuring good working equipment and a well-functioning internet connection that allows for proctoring if you take the digital route (see page 8 for the proctoring specs).

Step 6 - Take the CST
The **CST** can be completed on **1, 2, or 3 March**. You will take the CST on the date and within the timeframe confirmed to you. The score on each of the three elements will count for 25% towards the final ranking number (CST = 75%).

Step 7 - Complete the Teamwork assignment
For the last step of the selection part of the procedure you will be assigned to a group. With this group you will have to complete a teamwork assignment, between **8 March** and **14 March**. The teamwork assignment will be graded by your participation, collaboration and teamwork skills. The score will count for 25% towards the final ranking.

Step 8 - Receive your ranking number
You will receive your **ranking number** in **Studielink** on **April 15**. If your ranking number is within our fixed capacity, you will automatically receive a (conditional*) offer for the academic year 2022/2023. If your ranking number is higher, it is possible to receive an offer at a later point in time, as not all candidates will accept their spot.

Step 9 - Accept your spot
Make sure to check your email regularly as you need to accept a spot within 2 weeks in Studielink. Remember to finalize your registration and upload all required documents.

*Admission requirements
Please note that participating in the Matching & Selection procedure or receiving a ranking number, does not automatically mean that you meet the admission requirements, as this constitutes a separate process.
How to prepare for the Matching & Selection

For the selection procedure you will be tested on 4 selection criteria: Mathematics, Systematic Reasoning & Logical Thinking, Algorithmic & Computational Thinking and Teamwork. Some elements you can prepare for and some elements not. You can find the specifics for each element below:

Mathematics
You can prepare for this element by following the free online pre-university calculus course (select the audit track) and by reading the syllabus and formula sheet, which can be found in the appendix of this brochure. The syllabus will give you a better insight into what is expected from you in this test. You should be able to apply techniques and formulas from memory, except for the formulas on the formula sheet, which will be available online during the test. Please remember that you will need to do all calculations by yourself as a calculator is not allowed.

Systematic Reasoning & Logical Thinking
You can prepare for this element by studying chapter 2 of the textbook Delftse Foundations of Computation. You can skip all the sections starred (*) in the contents of the book, as explained in chapter 1. This book can be downloaded for free from the TU Delft Open Textbook repository. At TU Delft we train our students to become analytical engineers and curious problem-solvers. Although you will find exercises in the book, you will not find any official answers, nor do we provide any more than those already included in the book.

Algorithmic & Computational Thinking
In the last part of the CST we will test your potential to solve puzzles, process-oriented thinking skills and your ability to come up with efficient solutions to real-world computational problems. You cannot prepare for the Algorithmic & Computational Thinking as this is an aptitude test.

Teamwork
The last step of the Matching & Selection procedure is a teamwork assignment. You will be assigned to a team formed with other candidates to work a problem-solving assignment. No programming experience is required for the teamwork assignment. You cannot prepare for the Teamwork assignment.

Taking the Cognitive Skills Tests (CST)
The Cognitive Skills Tests (CST) contains the following three tests:
- Mathematics (25%)
- Systematic Reasoning & Logical Thinking (25%)
- Algorithmic & Computational Thinking (25%)

The percentages between brackets indicate the relative weight used to calculate your final grade. The complete CST will take a maximum of tree hours to complete. Each of the three tests take one hour to complete. Per test a counter will stay visible showing the remaining time. Once you start the first test, you have to complete all three tests in one session. The test can only be taken in the set order as shown in this document. You cannot re-sit or re-take the CST.
Set-up of the CST
The questions will gradually become more difficult within all three tests of the CST. Your goal is to answer as many questions correctly as possible. Your score for each test element is solely based on the number of correct answers. The tests are designed such that the time available may not be sufficient to answer all questions. You can go forward and backward between questions within a test. Please note that once you have completed a test and have started with the next test, you cannot go back to the previous test, any time you had left for that particular test will be lost.

Proctoring
To ensure an honest selection procedure all candidates who take the CST online will be remotely proctored, which means that candidates are “followed” online to check whether the test is completed under the correct conditions. You and your computer screen will be monitored during the CST to ensure that you comply with the academic integrity standards of the TU Delft.

Proctoring requirements
When you take the CST online, make sure to check in advance whether you meet the requirements as set by our proctor:

**Hardware Requirements**
- Working web camera (using your phone as webcam is not allowed).
- Your computer needs to have a microphone (headsets or ear pods used as microphone is not allowed).
- You are only allowed to have one screen.
- You cannot use tablets, hybrid devices, mobile devices, Chrome Casts, Linux Machines and Chrome Books.

**Operating System Requirements**
- You can only use Windows or Mac operating systems.

**Connectivity Requirements**
- You need to have stable internet connection. Maintaining a minimum connection speed of 500kbps is required during proctoring. We recommend using a cable connection as opposed to WiFi.
Candidate responsibilities

Note that you are responsible for assuring good working equipment and a well-functioning internet connection. In addition to that you will need to take a test prior to the CST to ensure that you know how proctoring works, as well as read all the required information that will be provided online. TU Delft cannot guarantee that proctoring will work in all countries, as some countries have strict regulations and firewalls, which may mean that you require a VPN connection. **You are responsible yourself to ensure you are able to take the CST online.**

Academic integrity

Make sure you have a good environment to take the CST. Make sure that your phone is completely switched off and out of sight. Let the people around you know that you are taking the CST so they do not disturb you (which could be seen as fraud) or make a lot of noise which could distract you during the test.

All candidates taking the CST need to comply with the academic integrity standards of the **TU Delft**. You will need to take the tests individually and without other sources of information. It is **not** allowed to share questions or answers of the CST with third parties. Any (attempted) act or omission thereof that may result in making it more difficult or impossible to form an objective assessment constitutes fraud. The Selection Committee can impose sanctions on fraud, like awarding zero points or excluding a candidate from the procedure.

What is **not** allowed during the CST

- A calculator is **not** allowed, nor is a calculator on an other device
- Use of a second computer is **not** allowed
- Use of a (smart) phone is **not** allowed
- Use of any other mobile device than the device on which the test is taken is **not** allowed
- Headphones or earplugs are **not** allowed (even if they are only noise cancelling)
- It is **not** allowed to have someone else in the room in which the test is taken nor is it allowed to have a radio or television playing in the background.
How your ranking number is calculated

All candidates have to complete all steps in the Matching & Selection procedure in order to obtain a ranking number. Your ranking number will be based on the assessments that took place during the Matching & Selection days, consisting of four components:

- Mathematics (25%)
- Systematic Reasoning and Logical Thinking (25%)
- Algorithmic & Computational Thinking (25%)
- Teamwork (25%)

The ranking numbers are computed in accordance with a strict protocol. This process is overseen by the CSE Selection Committee. The individual scores will be converted to z-scores and combined into your final cumulative z-score. All final z-scores (both from the digital and on campus route) will be combined into one final ranking list.

A z-score or standard score, is a relative score, as it compares how you did on the tests in relation to the performance of the other candidates. As a result there is no fixed pass or fail grade. Higher tests scores will result in better (=lower) ranking numbers. The candidate with the highest final score will thus receive the lowest ranking number, the candidate with the second highest score will receive the next ranking number, and so on. As educational systems differ per country, as well as ways to calculate average grades, your high school grades are not taken into account when calculating your ranking number. Please note however that a (strong) correlation between your high school grades and your performance on the tests is likely.

How ranking works in Studielink

On April 15 Studielink will announce your ranking number. You will also receive an email with your final cumulative z-score, on which your ranking number has been based. For reasons of confidentiality and objectivity we will not communicate about the method and evaluation of the criteria, nor is it possible to review the tests or individual answers given.

Please note that assigning spots is an automated process in Studielink. If your ranking number is within our maximum capacity, you will automatically receive an (conditional) offer. You will have two weeks to accept this offer in Studielink. If you do not accept or respond within two weeks, this spot will automatically be reassigned to the next registered candidate on the ranking list who hasn’t received an offer yet. If your ranking number is higher than the available capacity, you will have to wait until one of the other applicants declines their offer or opt for one of your alternative study choices. Please keep in mind that after April 15, applicants with ranking numbers above our maximum capacity can still be offered a spot, so make sure to check your email and Studielink on a weekly basis, as this process continues throughout summer.

More information

- Admission & Application
- BSc CSE Matching & Selection
- FAQ
- selection-bsc-cse@tudelft.nl

Disclaimer Please keep in mind that updated information will be provided by email throughout the process.
Timeline Digital Route
Application and Matching & Selection BSc CSE 2022/2023

1. Application
   A. Apply in Studielink
   B. Activate your TUD Net ID
   C. Continue in Osiris

2. Confirm your Route (Campus or Digital)
   Includes choosing a CST date and completing a survey.

3. Complete Online Student Experience

4. Confirmation CST date

5. Trial Run Proctoring
   Test the proctoring software on the computer you will use to take the CST.

6. Take the CST
   Complete the three parts of the CST, proctored and on your own computer.

7. Complete Teamwork Assignment

8. Ranking
   Studielink informs student of rank#

9. Accept & Finalize
   A. Accept your spot within 2 weeks
   B. Finalize registration in Studielink

Start in time, all deadlines are fixed!

Timeline Digital Route 2022/2023
Appendix

Syllabus 2a Mathematics Test

Below the minimum of expected knowledge for mathematics is presented. Note that the questions on the respective test might consist of a combination of multiple topics. The content in this syllabus is based on the material covered in Dutch VWO (i.e. pre-university education) schools.

The standard mathematical terms are written in **boldface**. Note that these terms might be very different in your native language. It is advised to check those terms carefully, look up the terms that you do not recognize and make a list of translations to your native language.

**Mathematics**

The math problems can and have to be solved exactly, i.e. without using approximation techniques or a calculator. Moreover, unless stated otherwise, this also implies that you should not round your answers (e.g. 0.33 is not considered the same as 1/3).

1. Functions and Graphs

   i The candidate is able to recognize and construct compositions of standard functions. Standard functions include.

   - **polynomial functions**,
   - **n-root functions** ($\sqrt[\ell]{x}$, $x^{\frac{1}{\ell}}$),
   - **power functions** ($x^a$, $a$ fixed),
   - **exponential functions** ($a^x$, $a$ fixed. Specifically $e^x$),
   - **logarithms** ($\log_a(x)$, $a$ fixed. Specifically the natural logarithm $\ln(x)$),
   - **trigonometric functions** ($\sin(x)$, $\cos(x)$ and $\tan(x)$),
   - the **absolute value function** ($|x|$).

   ii The candidate is able to analyze, and transform (compositions of) these standard functions, to determine limits, domain, range, asymptotes and symmetry-points or -lines and to draw and recognize graphs of (compositions of) these functions.

   iii The candidate understands the concept of **inverse functions**, and can find the inverse of (compositions of) standard functions.

2. Algebraic manipulations an solving equations

   i The candidate can rewrite expressions to isolate a variable and can substitute expressions into a given function.

   ii The candidate is able to rewrite expressions into simplified form and use this skill to manipulate and solve equations and inequalities of the form $f(x) = g(x)$, $f(x) \leq g(x)$, $f(x) \geq g(x)$, $f(x) < g(x)$, $f(x) > g(x)$ and $f(x) \neq g(x)$, where $f$ and $g$ are (compositions of) standard functions (see ii)
iii The candidate is able to find roots of a function \((f(x) = 0)\) using factorization techniques. The candidate is able to use the quadratic formula to find roots of quadratic polynomials \((ax^2 + bx + c = 0)\).

iv The candidate can solve systems of linear equations, 
\[
\begin{align*}
ax + by &= c, \\
dx + ey &= f,
\end{align*}
\]
with \(a, b, c, d, e, f\) constants.

3. Differential Calculus

i The candidate knows the derivatives of standard functions, and is able to apply the sum rule, product rule, quotient rule, and chain rule to determine derivatives of functions composed of standard functions.

ii The candidate is able to determine the first derivative \((f'(x), \frac{dy}{dx}, \frac{d}{dx}f(x))\) and second derivative \((f''(x), \frac{d^2y}{dx^2}, \frac{d^2}{dx^2}f(x))\) of functions and to use these to determine locally increasing and locally decreasing behavior, extremal values, and inflection points.

iii The candidate is able to apply differentiation to determine the slope of a graph and the local tangent lines and normal lines to the graph of a function, to construct and solve a optimization problems, and to solve problems concerning distance, velocity and acceleration.

4. Integral Calculus

i The candidate understands the concept of integration and related terms (including limits of integration, definite/indefinite integrals and the integration constant).

ii The candidate is able to determine antiderivatives (also called primitive functions) of standard functions, and is able to use this to calculate definite and indefinite integrals of functions of the form \(cf(ax + b) + d\), with \(a, b, c, d\) constants and \(f\) a standard function.

iii The candidate is able to apply integration to determine surface area and volume of a solid of revolution and the mean value of a function.

5. Trigonometry

i The candidate understands the trigonometric functions \(\sin(x), \cos(x)\) and \(\tan(x)\) and their relation to the unit circle. The candidate understands the terms amplitude, phase, period, and frequency and can relate these to the parameters in a sinusoidal function such as \(f(t) = d + a\sin(b(t - c))\). The candidate is able to convert degrees to radians and vice-versa.

ii The candidate knows the exact values of \(\sin(\theta), \cos(\theta)\) and \(\tan(\theta)\) for the following angles (in radians) \(\theta = 0, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}\) or \(\frac{3\pi}{4}, \frac{\pi}{2}, \frac{2\pi}{3}, \frac{5\pi}{6}\), as well as integer multiples of these angles.

iii The candidate knows is able to use periodicity and symmetry properties of \(\sin(\theta), \cos(\theta)\) and \(\tan(\theta)\).

iv The candidate is able to find all solutions of equations \(\sin(x) = c, \cos(x) = c\) and \(\tan(x) = c\), and of \(\sin(f(x)) = \sin(g(x)), \cos(f(x)) = \cos(g(x))\) and \(\tan(f(x)) = \tan(g(x))\), where \(c\) is a constant and \(f(x)\) and \(g(x)\) are linear functions of \(x\).

v The candidate is able to find all solutions of equations \(\sin(x) = c, \cos(x) = c\) and \(\tan(x) = c\), and of \(\sin(f(x)) = \sin(g(x)), \cos(f(x)) = \cos(g(x))\) and \(\tan(f(x)) = \tan(g(x))\), where \(c\) is a constant and \(f(x)\) and \(g(x)\) are linear functions of \(x\).
vi The candidate is able to solve inequalities \( \sin(f(x)) \leq c, \cos(f(x)) \leq c \) and \( \tan(f(x)) \leq c \), where \( c \) is a constant and \( f(x) \) and \( g(x) \) are linear functions of \( x \). The same for \( \leq \) replaced with \(<, > \) or \( \geq \).

vii The candidate is able to apply the Pythagorean identity \( \sin^2(x) + \cos^2(x) = 1 \), sum and difference identities and double angle formulae.

6. Geometry

i The candidate is able to determine the surface area and perimeter length of two-dimensional shapes including triangles, rectangles, circles, etc. The candidate is able to determine the volume and surface area of three-dimensional objects including cubes, pyramids, cylinders, cones, etc.

ii The candidate can use properties of lines, triangles, circles, and quadrilaterals to determine lengths and angles. The candidate knows and can use the properties of a right-triangle, isosceles triangle, and equilateral triangle.

iii The candidate can use the Pythagorean theorem, relations between sin, cos and tan, the law of sines and the law of cosines to determine lengths and angles in triangles.

iv The candidate can formulate equations for lines and circles, and knows the relations between the slopes of normal and tangent lines.

v The candidate is able to find the points of intersection between lines and circles.

7. Vectors

i The candidate understands the concept of a vector, and can determine the norm (i.e. length) and direction of a vector.

ii The candidate can decompose vectors into components, can multiply a vector with a scalar, and can add and subtract vectors. The candidate can calculate the dot product of two vectors, and can use it for the calculation of angles and distances and to detect orthogonality.

iii The candidate can calculate speed, velocity and acceleration of a moving point whose path is described by a time-dependent vector representation.

Remark:
Vectors will be denoted boldface or with an arrow: \( \mathbf{v} \) or \( \mathbf{v} \). When expressed in components, a vector will denoted using round brackets, e.g. \( \left( \begin{array}{c} 3 \\ -5 \end{array} \right) \). The norm (= length) of a vector \( \mathbf{v} \) will be denoted as \( ||\mathbf{v}|| \).
Trigonometry

Pythagorean identity

\[ \cos^2(x) + \sin^2(x) = 1 \] (1)

Angle sum and difference identities

\[ \cos(\alpha - \beta) = \cos(\alpha) \cos(\beta) + \sin(\alpha) \sin(\beta) \] (2)

\[ \cos(\alpha + \beta) = \cos(\alpha) \cos(\beta) - \sin(\alpha) \sin(\beta) \] (3)

\[ \sin(\alpha - \beta) = \sin(\alpha) \cos(\beta) - \cos(\alpha) \sin(\beta) \] (4)

\[ \sin(\alpha + \beta) = \sin(\alpha) \cos(\beta) + \cos(\alpha) \sin(\beta) \] (5)

\[ \tan(\alpha - \beta) = \frac{\tan(\alpha) - \tan(\beta)}{1 + \tan(\alpha) \tan(\beta)} \] (6)

\[ \tan(\alpha + \beta) = \frac{\tan(\alpha) + \tan(\beta)}{1 - \tan(\alpha) \tan(\beta)} \] (7)

Double-angle formulae

\[ \cos(2x) = \cos^2(x) - \sin^2(x) \] (8)

\[ = 2 \cos^2(x) - 1 \] (9)

\[ = 1 - 2 \sin^2(x) \] (10)

\[ \sin(2x) = 2 \sin(x) \cos(x) \] (11)

\[ \tan(2x) = \frac{2 \tan(x)}{1 - \tan^2(x)} \] (12)
Integrals

\[ \int x^a \, dx = \frac{x^{a+1}}{a+1} + C \quad (a \neq -1) \quad (13) \]
\[ \int a^x \, dx = \frac{a^x}{\ln(a)} + C \quad (a \neq 1) \quad (14) \]
\[ \int \frac{1}{x} \, dx = \ln |x| + C \quad (15) \]
\[ \int e^x \, dx = e^x + C \quad (16) \]
\[ \int \ln(x) \, dx = x \ln(x) - x + C \quad (17) \]
\[ \int \log_a(x) \, dx = \frac{1}{\ln(a)}(x \ln(x) - x) + C \quad (a > 0 \text{ and } a \neq 1) \quad (18) \]
\[ \int \sin(x) \, dx = -\cos(x) + C \quad (19) \]
\[ \int \cos(x) \, dx = \sin(x) + C \quad (20) \]