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 On Campus 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 - How to choose your study on 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.

On Campus 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 will have 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 On Campus route you can expect the following:

The On Campus route consists of 3 on-campus Matching & Selection days in which you will follow lectures, workshops and participate in a group project. 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%)

The Matching & Selection days are a unique opportunity to experience what it is like being a student at the TU Delft and to meet other prospective students. The Matching & Selection days offer you more insight into your match with the programme at the TU Delft. The detailed program will be sent to you by email if you choose this route. The dates and times of the Matching & Selection days are already set: 3 February, 11 February, 4 or 5 March (see timeline at the end of this document for more information). The Matching & Selection days will be held in English because the bachelor is fully taught in English.

Note that you are required to be present on campus on all 3 Matching & Selection days. No exception can be made. If you cannot be present on one or more days you will have to follow the Digital Matching & Selection route.

Disclaimer Please keep in mind that updated information will be provided by email throughout the process.
When you have attended all the Matching & Selection days you will:

- Have experienced what it is like to study CSE at the TU Delft.
- Have good impression of the bachelor CSE and whether it is a suitable programme for you.
- Know what skills you can improve to prepare yourself even better for next year.
- Have met fellow prospective students.
- Receive a ranking number on April 15.

**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
On Campus Matching & Selection route in 8 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. 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.

Regulation

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 - Confirm your route

You will be contacted by email before January 22 to choose your route (On Campus or Digital). If you choose the On Campus route you will be asked to deliver the following information:

- Confirmation that you are able to attend all three Matching & Selection days (day 1: 3 February / day 2: 11 February / day 3: 4 or 5 March).
- Only for candidates who are in their last year of secondary school (e.g. 6 VWO): Approval from your school to attend the Matching & Selection days (which will partly be during regular school hours).
- Whether you want to attend the third Matching & Selection day on the 4th or 5th of March.
- Completion of the Matching Surveys.

Step 3 - Receive confirmation of participation

You will receive a confirmation of your registration for the On Campus route before January 27 by email. The email will include a detailed programme of the On Campus days.
Step 4 - 1st on-campus Matching & Selection day
3 February 2022 - 13:00-17:00
On the first day the focus will be on mathematics, systematic reasoning and logical thinking. You will follow two lectures about these topics and make a few assignments to practice. There will also be an opportunity to ask questions about the CSE bachelor.

After completing the first Matching & Selection day candidates are given the option to switch to the Digital route. This is the last moment to make a switch. Students who stay in the On Campus route, but do not attend all activities, will not be granted placement in the Computer Science Engineering Bachelor for the academic year 2022/2023.

Step 5 - 2nd on-campus Matching & Selection day
11 February 2022 - 13:00-17:00
On the second day we will start with a Q&A about the homework, after which you will make a test about the topics discussed in the prior lectures. The test will assess the 1) Mathematics and 2) Systemic Reasoning & Logical Thinking criteria and count for 50% towards your final ranking. After the test you will follow a introductory lecture about programming and algorithmic and computational thinking.

Step 6 - 3rd on-campus Matching & Selection day
4 or 5 March 2022 - 11:00-17:00
The third on-campus day is split into two sessions on different days, of which you have to attend one. You will be divided into teams to work on a problem-solving assignment. The assignment will test the 3) Algorithmic & Computational Thinking and 4) Teamwork criteria and count for 50% towards your final ranking. No prior programming experience is needed for the teamwork assignment. After working on the project, you and your team will present your work to the teachers and other students at the end of the day. We will end the Matching & Selection with a plenary closure.

Step 7 - Receive your ranking
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 8 - 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.
Need to know before choosing the On Campus route

- The Matching & Selection days are not orientation days. We expect you to have attended other orientation activities and programmes at the TU Delft (or at other universities) before deciding to apply for Computer Science & Engineering at the TU Delft. We expect that your participation in the CSE Matching & Selection procedure is a well-considered decision based on thorough information gathering regarding the programme and university.

- If you are currently following secondary education (e.g. VWO 6), your school has to sign a letter of approval to attend since the Matching & Selection days could interfere with regular school hours. If your school does not allow you to miss lessons, you will have to follow the Digital route.

- If you choose to take the On Campus route, you are required to attend all three Matching & Selection days in order to receive a ranking number*. If you know in advance that you cannot be present on one or more Matching & Selection days you will have to follow the Digital Matching & Selection route. No exceptions can be made.

- The mandatory On Campus day will be on:
  ◊ 3 February (day 1)
  ◊ 11 February (day 2)
  ◊ 4 or 5 March (day 3)

- You are expected to prepare the homework given to you before attending the on campus activities. The first homework assignment will be handed to you after the first on-campus day.

- The assignments that you complete on campus will asses the selection criteria and together constitute 100% of your final score.

- You have the right to stop with the Matching & Selection procedure at any time. After the first Matching & Selection day there will be a chance to switch to the Digital Matching & Selection route (until 9 February). After 9 February it is not possible to switch to the digital route any more. If you stop with the On Campus route after 9 February you will not receive a ranking number.

- The Matching & Selection days will be held in English.

- There are no additional costs to participate in the On Campus Matching & Selection days.

Extra time
Candidates who have been diagnosed with a learning disability and/or are experiencing extenuating circumstances can request extra time for the Systematic Reasoning & Logical Thinking and Mathematics test on the second campus day 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 February 1st, stating your full name and student number.

*In the case that the Dutch government imposes restrictions due to the Corona pandemic on physical attendance, an (online) alternative to the campus meetings will be organized.
How to prepare for the 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. 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

You will be tested on 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

A teamwork assignment is included the Matching and Selection procedure. You will be assigned to a team with other candidates to work on a problem-solving assignment. No programming experience is required for the teamwork assignment. The details of the assignment will be explained on the day itself. You cannot prepare for the Teamwork assignment.

Preparation On Campus days

You will receive instructions during the first campus day about what to prepare for the subsequent days.
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.
Timeline On Campus 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

Apply
1st Oct - 15th Jan 23:59 CET

2. Confirm your Route
   Including completing a declaration of attendance and completing a survey

Confirm your Route
22nd Jan - 25th Jan 23:59 CET

3. Receive confirmation participation
   You will receive a confirmation and the program by email.

Confirmation participation
Before 27th Jan

4. 1st Matching & Selection day
   Mandatory Matching & Selection day on campus. The last chance to switch to the Digital Route is 8 Feb 23:59 CET.

On campus day: Thursday 3rd February 13:00 – 17:00 CET

5. 2nd Matching & Selection day
   Mandatory Matching & Selection day on campus.

On campus day: Friday 11th February 13:00 – 17:00 CET

6. 3rd Matching & Selection Day
   Final Matching & Selection day on campus. You can sign up for the day of preference.

On campus day: Friday 4th or Saturday 5th March 11:00 – 17:00 CET

7. Ranking
   Studielink informs student of rank#

Receive ranking# starting 15th April

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

Accept spot within 2 weeks

Start in time, all deadlines are fixed!
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** ($\sqrt[\,n\,]{x}$, $x^{\frac{1}{n}}$), 
   - **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 1i)
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 an 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 those 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) \(\theta = 0, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}\) and \(\frac{\pi}{2}, \frac{\pi}{3}, \frac{\pi}{4}, \frac{\pi}{6}\), 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 \( \vec{v} \). 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

\[
\int x^a \, dx = \frac{x^{a+1}}{a+1} + C \quad (a \neq -1) \\
\int a^x \, dx = \frac{a^x}{\ln(a)} + C \quad (a \neq 1) \\
\int \frac{1}{x} \, dx = \ln |x| + C \\
\int e^x \, dx = e^x + C \\
\int \ln(x) \, dx = x \ln(x) - x + C \\
\int \log_a(x) \, dx = \frac{1}{\ln(a)}(x \ln(x) - x) + C \quad (a > 0 \text{ and } a \neq 1) \\
\int \sin(x) \, dx = -\cos(x) + C \\
\int \cos(x) \, dx = \sin(x) + C
\]