Rules for the Mental Calculation World Cup 2024

General Information

The entry form and more information about the event can be downloaded from www.recordholders.org/en/events/worldcup/.

Registration and Qualification

Only qualified mental calculators who have received a registration confirmation from the organizer are eligible for participating in the Mental Calculation World Cup.
Participants can take part in all categories or just in selected categories of their choice.

In order to get qualified, the participant will have to register by sending the entry form until 15 June 2024. For registrations arriving after 15 June 2024, there is no guarantee that they will be considered in the qualification. They can, however, be discussed on an individual basis.

The number of participants is restricted to 40. If a qualification is necessary, the organizer will make sure that:
>   a) the mental calculators with the best achievements will be invited and
>   b) calculators from a large number of countries will be invited

In the registration form, any previous achievements on mental contests (mental calculation, memory, mental puzzles, mental games) should be documented.
In addition, the scores achieved with the Memoriad computer program (http://memoriad.com/memoriadsoftware.asp) in the mental calculation categories should be documented (category, number of correct answers, time). These results must be confirmed by a witness with some background in mental calculation (for example a maths teacher).
This information will be used for making the decision about the calculators who qualify for the MCWC.

Titles

The following titles will be awarded:

- *"Mental Calculation World Cup Champion - Combination"*
- *"Mental Calculation World Cup Champion - Most Versatile Calculator"*
- for the winner in the category "Addition": *"Mental Calculation World Cup Winner in the category addition"*
- for the winner in the category "Multiplication": *"Mental Calculation World Cup Winner in the category multiplication"*
- for the winner in the category "Extracting Square Roots": *"Mental Calculation World Cup Winner in the category Extracting Roots"*
- for the winner in the category "Calendar from Memory ": *"Mental Calculation World Cup Winner in the category Calendar from Memory"*

Jury

The jury will consist of at least three suitable persons (e.g. mathematicians or math teachers). At least one member of the jury will speak German and one member will speak English. The organizer will do their best to provide translators for participants who speak neither German nor English.

Categories

The overall competition is divided into ten single categories:

1) The calculation of the day of the week from randomly selected dates of the years 1600 to 2100
2) Addition of ten ten-digit numbers
3) Multiplication of two eight-digit numbers
4) Extracting the square root from a six-digit number (solution has to be given with eight significant digits)
5)- 9) "surprise problems", which are unknown to the participants prior to the competition. These problems can include only basic arithmetic operations (addition, multiplication, subtraction and division), raising powers with integer exponents or roots with integer exponents.

General Rules

All participants should be familiar with the rules prior to the competition, as there will be no time for explaining them during the competition.

A sheet of paper which contains several randomly selected mathematical problems from a category will be put on the table in front of each participant. All participants will get the same set of problems. After the starting signal each participant has to turn over his/ her sheet of paper and solve as many problems as possible in the given time. The solution of each problem is to be noted readable beside or below each problem. Unreadable solutions will be regarded as being wrong in case of doubts!

All problems must be solved mentally; aids and written calculations (i.e. writing down auxiliary calculations or intermediate results) are not permitted! If a solution has to be corrected, this should be done clearly on the sheet. The possibility of correction must not be misused to write down intermediate results.

For rating the answers given by the calculators, the following principle applies: Correct solutions are more important than speed.

For physically handicapped participants, who are unable to read the problems, hear the explanation of the surprise problems or write down the solutions, the jury may set special rules.

All participants should be absolutely quite during the competition. If someone disturbs other participants, he or she can be disqualified. In particular, participants, whose mobile phone starts ringing during the competition, will be disqualified immediately!

Schedule

The contests will be held on two days. For addition, multiplication, square roots and calendar calculation, there will be two rounds with different tasks.

There will be breaks (at least 5 minutes) between the rounds.
After the first round in the Calendar category, the participants can compare their answers with the correct results.

For all rounds, the procedure is as follows:

1. receiving of the exercise sheet
2. filling in of the name fields
3. concentration time (one minute, for surprise tasks: 2 minutes)
4. start command: "Neurons: On the ready, go!"
5. announcements when 5 minutes / 1 minute / 10 seconds remain (acoustic signal)
6. stop command: "Three, two, one, stop!"

After the stop command, the exercise sheet has to be turned upside down instantly. Any further use of writing tools after the stop command is prohibited; otherwise the jury may take sanctions.

The interruption of a round is only possible by the head of the jury. Protests by participants due to unforeseen events are only possible after the end command (to limit disturbance of other participants).

Special rules for single competitions

1) <u>Addition of ten ten-digit numbers.</u>
   Time to solve the problems: *7 minutes*
   Problems of the following type will be asked:

```
 4190187220
+3967093178
+8567125486
+1005683165
+3635944647
+7645865467
+3506970235
+6710259450
+2347894647
+4995420559
```

All numbers will be randomly selected and will contain ten digits; zero as the first digit is impossible.
The required solution is the sum of the ten numbers.
The tasks can be solved in any order.

2) <u>Multiplication of two eight-digit numbers</u>
   Time to solve the problems: *10 minutes*
   Problems of the following type will be asked:

```
 18467941
·73465135
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(If a participant prefers to get the problem as 18467941·73465135 in a single row, he or she can request a task sheet that shows the problems in this way.)
All numbers, containing eight digits, will be randomly selected; zero as first digit is impossible, though zeros and ones are possible at every other position, including the last. The solution is be the product of both numbers.
The tasks can be solved in any order.

3) <u>Extracting the square root from a six-digit number (solution with an accuracy of eight digits).</u>
   Time to solve the problems: *10 minutes*
   Problems of the following type will be asked:

$$\sqrt{530179}$$

All numbers, each containing six digits, will be selected randomly; zero as the first digit is impossible.
The tasks can be solved in any order.

4) <u>Calendar from memory</u>
   Time to solve the problems: *1 minute*
   problems of the following type will be asked:

   08-12-1721 (for 8 December 1721. The first number will be the day, the second number will be the month!)

All dates will be randomly selected from the years 1600 through 2100. All dates are assumed to be Gregorian calendar dates.
The required solution is the correct day of the week of the given date (Monday in the example).

If participants prefer to get their problems in another way, for example as "8/DEC/1721", they must send the required format by e-mail to info@recordholders.org until the 1 August 2024.

For the days of the week abbreviations are permitted if they clearly show the day of the week <u>in an actually existing language</u> (e.g.: In German Mo, Di, Mi, Do, F, Sa, So; in French L, Ma, Me, J, V, S, D would be sufficient.)

Alternatively, numbers can be used to represent the day of the week (e.g. 1=Monday, 2=Tuesday etc.). For each day of the week, <u>exactly one</u> abbreviation has to be used. It would, for example, not be allowed to use as well 0 as 7 or Su for representing Sunday.

Prior to the competition each participant has to write down on a special sheet of paper, which abbreviations he or she wants to use for each day of the week. If the abbreviations are unclear or do not follow the above rules, the solution will be rated as being wrong.

5-9) <u>Surprise problems</u>

Time to solve the problems: *10 minutes*

In these rounds, either a number of problems of the same type will be asked or a single task will be given. The type of the tasks is unknown to the competitors prior to the event.

Scores for the single competitions

For those categories where two rounds are contested, **only the better result counts** for each participant. Only if two participants share the same result in a single competition, the result of the other round will be considered to determine the ranking between those participants.

Participants can forego their right to take part in one of both rounds. In this case, this round is counted with a score of 0.

The ranking of the participants of a single competition will be determined for every single category.
This will be done in the following way:
For the categories:

<u>1) Addition of ten ten-digit numbers, 2) Multiplication of two eight-digit numbers, and 3) Extracting the square-root from a six-digit number</u>

Sufficiently many tasks will be given. They can be solved in any order.

Every correct solution scores one point, but a wrong or incomplete answer scores minus one point.

An incomplete answer of the last task which was attempted to solve is not to be treated as a wrong answer.

The lowest possible score is 0; no negative points will be given.

All participants with the same number of points will be ranked equally.

For the square roots-category, a solution will be regarded as being correct if it is close enough to the correct answer. Formally: If the challenge is to compute $\sqrt{N}$, and E was written down as the solution, than it is regarded as correct if and only if $|E - \sqrt{N}| \le 5 \cdot 10^{-6}$.

The problems are numbered from a_1 through a_{100}.
Let k be the highest number for which the following applies: "Among the problems a_1 through a_k there is at most one problem either not or wrongly solved." Then this will lead to a score of k-1 points.
(Or to put it differently: The highest number of correctly solved problems, where at most one mistake is allowed; a second mistake will end the attempt. It doesn't matter how many correctly calculated problems follow after the second mistake.)

5) - 9) Surprise problems

The scoring system for the surprise problems will be announced prior to the surprise contests.

Scores for the combined competitions

Using the procedure above, a score will be given for each single category. If someone is not participating in a category, he or she will enter the ranking for this category with the score 0. If two rounds are held for a category, only the better result of each participant will be taken into account.

The best participant in each category gets a score of 100 for the overall competition.

A participants' result in one category adds to his overall points as follows:

Points = 100 · (score of this participant in the category) / (winner's score in the category) , rounded at two decimal places.

The ranking in the two main competitions will be calculated as follows:

for the contest "Combination":
The points achieved in all categories will be added towards the final result.

If two participants share the same final score, the scores in the second rounds for addition, multiplication, roots and calendar (which have been dropped so far) will be compared. If these scores sums up to the same result as well, the participants share the same rank.

for the "Most Versatile Calculator" contest:
The points achieved in the surprise tasks (5-9) will be added.