

Building Competitive Programmers from Day One: The FACOMpetindo Training Model

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Abstract. Programming, problem-solving, and logical reasoning skills are fundamental to student’s academic and professional development. In Brazil, competitions such as the *Olimpíada Brasileira de Informática* (OBI) and the *Maratona Feminina de Programação* (MFP) foster these competencies within the field of competitive programming.

In this context, this work presents FACOMpetindo, an initiative at the Faculty of Computing of the *Universidade Federal de Mato Grosso do Sul* (UFMS), in the state of *Mato Grosso do Sul*, Brazil, aimed at disseminating competitive programming, training students and strengthening participation in a number of contests.

Keywords: competitive programming, freshmen training, programming contests, educational methodology, Brazil.

1. Introduction

Competitive programming is classified as a Mind Sport [Nunes 2022], which means an intellectual competition focused on improving cognitive abilities. The programming tests aim to incentive problems’ resolution in a certain period of time, using algorithm’ knowledge and programming techniques. Between brazilian competitions, stand out the *Maratona de Programação da Sociedade Brasileira de Computação* (SBC Marathon, that can be translated as “Computing Brazilian Society’ Programming Marathon”), the *Olimpíada Brasileira de Informática* (OBI, or “Brazilian Informatics Olympiad”) and the *Maratona Feminina de Programação* (MFP, or “Feminine Programming Marathon”).

SBC Marathon, annually organized by the SBC, has been ongoing since 1996 and is intended to undergraduation and graduation students of computer-related areas. The competition evolve regional stages, where the best teams are qualified to the following stages, reuniting students of all around the world into the global stage from International Collegiate Pro-

gramming Contest (ICPC). SBC Marathon aims to promote participants' teamwork, logic thinking and creativity through problem resolution on different difficulty levels. The teams are composed by a coach (can be a professor) and three competitors (must be students), plus one, as a substitute; they shall solve the biggest amount of problems at the shortest time and with less penalties as possible¹.

In 2025, the Phase One (Regional Phase) of the Marathon counted on 1025 participating teams, presenting 239 institutions, realized simultaneously with other countries of Latin America, such as Bolivia, Mexico and Central America countries. In the Brazilian regions, the *Centro-Oeste* had the 2nd smaller participation, surpassing only the *Norte*. As a consequence, the participant's proportion on the Final Phase followed a similar pattern, with the *Sudeste* as a leader (49,2%), followed by *Nordeste* (18,5%), *Sul* (13,8%), *Centro-Oeste* (12,3%) and *Norte* (6,2%) as presented on Figure 1.

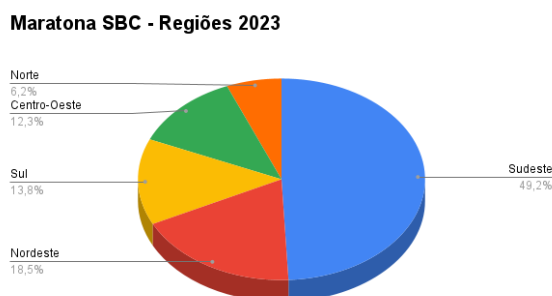


Figure 1. Regional participation graphic on 1st phase of Maratona SBC 2023

The OBI is focused on Middle and High School students (but also accepts from technical education and entrants in undergraduation), while the Marathon has 2 subscription categories and just 1 one them if for actual competitors (whereas the other is for practicing only), the OBI is divided in 2 different competition modalities²:

1. The introductory category consists of a test with logic and computer problems (programming logic, but without the use of a computer). This level is intended for elementary school students and is subdivided into: Junior Level, for fourth or fifth grade students; Level 1, for sixth or seventh grade students; and Level 2, for eighth and ninth grade elementary school students.
2. The programming category consists of a test with programming tasks that must be solved using a computer, much like the IOI. This modality is intended for elementary and high school students who have prior knowledge of some programming language. This modality is subdivided into Levels according to schooling: Junior Level, for students of any year of elementary school; Level 1, for students up to the first year of high school; Level 2, for students up to the third year of high school; and Senior Level, for

¹<https://maratona.sbc.org.br/>

²<https://olimpiada.ic.unicamp.br/>

students who are in their fourth year of technical school or who are, for the first time, in their first year of an undergraduate course.

Both Marathon and OBI foster girl participation by offering exclusive competitions. That's the case of the mentioned "MFP" and the feminine category of OBI. These have the objective of increasing female and non-binary people participation at competitive programming, which is usually low compared to male participation [Nunes et al. 2024, Silva et al. 2023]. The most impactful one being the MFP, incentivizing and covering up students from all country in a safe and welcoming event, composed of two stages, regional and final in "UNICAMP"³.

The participation in competitive programming events, as the mentioned ones, contribute to increase skills such as: problem solving; teamwork; innovation; creativity and computational thinking, which are fundamental abilities for students and professionals in the 21st Century [R. Raman and Achuthan 2018, Moura A. F. et al. 2019]. Therefore, the people who dedicate part of their time to competitive programming are the most probable to take up great positions in big companies such as "Google", "Amazon" and "Microsoft" [Nair 2020, WAGEED et al. 2024].

A well-documented challenge in STEM education and careers is the lack of diversity [Verdugo-Castro et al. 2022], reaching proportions such as 16% to 20% of women in the computational graduation courses. In 2023, the SBC Programming Marathon started directing about 10% of the slots for the Final Phase to teams with feminine competitors, improving the participation in 200% on this phase, and about 15% on 2024. This action also increased the first phase participation in 30% [Ramos et al. 2025], which demonstrates the necessity of female inclusion.

Facing the different approaches used for boosting competitive programming, we can observe that Quintela, Araújo and Pereira utilize a learning method applied to basic and high school classes that evolves weekly encounters, study trails on the course "*Programação Básica (Cod Cad) - De Zero a Herói*" (Basic Programming Cod Cad From Zero to Hero), focusing on C++. As a result, the methodology is structured focusing on competitive programming since high school. [Quintela and Ribas 2016]

On a related work, [Vianna et al. 2020] presents a mini course focused in construction and development of strategies on math and logical problem solving on different difficulty levels. The mini course relies on encounters and discussions about solutions based on previously elaborated strategies, integrating math and computing into competitive programming.

Finally, [Brito et al. 2019] applied, coupled with students of Computer Science at *Universidade Federal de Ouro Preto*, a methodology that combines gamification and online exercise platforms to incentive participation.

On this context, this work stands out by the production of online didactic material, weekly training, event organization and incentive *FACOM/UFMS's* student participation on olym-

³<https://www.instagram.com/mfp.sbc/>

piads and marathons. Those actions are conducted by a support network composed by volunteer professors and students. Thus, this work presents an experience report of the project *FACOMpetindo* since its creation on 2024, being focused on freshman from Computer related areas (Computer Science and Engineering, Software Engineering, Information Systems and Artificial Intelligence) on competitive programming.

The results include the developed materials and graphics that demonstrate the increase on student engagement on those competition. In the future, a deeper study will validate the project's impact on their course's motivation, as well as success rate and evasion.

2. Methodology

The main challenge in developing a training methodology, is the relative short span of a academic semester, where the students, specially the freshmen, also have to study for the other standard college subjects. Also, the new students at FACOM learn exclusively Python in their first semester. In this context, the methodology was divided in 3 parts, described below:

Trainings: The trainings are taught in every academic semester, occurring weekly in two distinct schedules, one of them in the morning and the other in the afternoon, despite this division, the same content is presented. The reasoning behind this separation is to achieve the maximum amount of interested students as possible, lessening schedule conflicts with the college subjects.

The chosen language for the trainings was C++ for being the most used language in the world for competitive programming. In light of the fact that the majority of the target audience are new students and that they learn exclusively Python in the beginning, it is necessary that the lessons start at the introduction of the language, explain the syntax and programming fundamentals like loops, if-else, variables and arrays. The remaining algorithms, techniques, and data structures taught are based on the OBI syllabus⁴ and other works [Manev 2024]. In the table 1 is presented the final syllabus planned and applied in the trainings of 2025/1.

Table 1. FACOMpetindo's Training Timeline 2025.1

Week	Content
01	Introduction to C++, Algorithm complexity
02	Sublime configuration, Loops, Conditionals
03	Vectors, Matrix, Strings
04	Prime Numbers, Euclides, Binary Search
05	Bits, Functions, Recursion
06	Ad-hoc, Greedy Algorithm
07	Test
08	STL e Union-Find

⁴https://olimpiada.ic.unicamp.br/prepare/ementas/ementa_prog/

09	Graphs, BFS, DFS
10	Dynamic Programming
11	Ending

As a supplementary training tool, a Training Spreadsheet was developed⁵, as shown in Figure 2. In this spreadsheet, a new tab was created each week with suggested exercises from the Codeforces and Beecrowd platforms to complement and practice the content covered. Furthermore, a kind of gamification was applied, where students enter their name and which exercises they managed to solve (AC), had an incorrect solution (WA), or had an inefficient solution (TLE) for the other students to see. A hint was also included for each problem, so that students could read it if they couldn't solve a problem initially.

The suggested exercises are analyzed and solved by volunteer students from the project. For each topic covered, some exercises are chosen that can be solved using the acquired knowledge, and many others that do not require the week's content to be solved, so that the progression between topics is smooth. All solutions are available online at <https://github.com/FACOMpetindo/beecrowd>.

The simulation was conducted on the ThemeCP platform, a website created to strengthen the practice of exercises in Codeforces, creating personal and customized contests. The closing ceremony includes gifts and some prizes for the students, such as the Fibonacci Award (most exercises solved) and the While (true) Award (highest attendance), to encourage and congratulate the students.

	A	B	C	D	E	F	G	H	I
1	SLIDES			Fácil			Médio		Difícil
2	Names:	Texto Bagunçado	Score	o sensor diferent	Coqueiros	Jogo de Basquetebol	Apelxorne	Verify password	Q mais rápido
3	DICAS ->	DICA	DICA	DICA	DICA	DICA	DICA	DICA	DICA
4	Miguel Bernal	AC	AC			AC	TLE		
5	Mateus Sposo	AC	AC	AC	AC		TLE		
6	Cássio Q Minozzo	AC	AC	AC	AC				
7	João Pedro Pinheiro	AC	AC	AC					
8	Ricardo Consolero			AC	AC	AC			
9	Rodrigo Kenji								
10	João Marcelo	AC	AC	AC					
11	Kaui Alves	AC	AC						
12	Larissa de Lima Santos	AC							
13	Yan Leandro R de Oliveira	AC							
14	João Pedro Huppel	AC	AC	AC					
15	Ana Clara M. Silva	AC							
16	Mateus Zeni	AC							
17	Daniely Maximo Marconi		AC						
18	Matheus Rocha	AC	AC	AC	AC				
19	Otávio Gabriel de Oliveira								
20									
21									
22									

Figure 2. Training Spreadsheet

Online Study Material: An online study material was developed⁶ as well, using the *Gitbook*⁷ platform, to facilitate asynchronous learning, targeting students who cannot attend the in-person trainings. The content presented aims to replicate what is covered in class, with code in both Python and C++. At the end of each section, the reader is provided with some exercises from the Beecrowd platform related to the topic discussed.

⁵https://docs.google.com/spreadsheets/d/1kXiKp2OSLasikJap7iRK_

⁶<https://facompetindo.gitbook.io/programacao-competitiva>

⁷<https://www.gitbook.com/>

Event organization: Another key point of the FACOMpetindo methodology is organizing events whenever possible, whether these are the local headquarters for official competitions or their own events. An example of the latter is the *Esquentando FACOMpetindo* (FACOMpetindo Warm-up), an event held for the first time in 2025 in an online format. The aim of this event was to create a real but accessible competition, with exercises selected by project members and targeting undergraduate students in the state.

The first edition of the FACOMpetindo Warm-up had 18 competitors⁸, 17 from UFMS and 1 from UCDB, another college in the same city. In 2026, the second edition of the FACOMpetindo Warm-up is planned, but this time in a face-to-face format.

3. Participation in Competitions

By applying the methodologies described above, an increase in curiosity and interest in participating in events related to competitive programming was observed. The following describes the frequency and results achieved by FACOM students in the biggest competitions in Brazil.

Since the project was structured in 2024, the participation of FACOM students in the OBI has been increasing significantly. In 2025, phase one of the OBI had more than 40 freshmen representing the faculty, out of a total of 56 registered, which represents a new record in both participation and registrations; of these, 10 students achieved perfect scores on the exam.

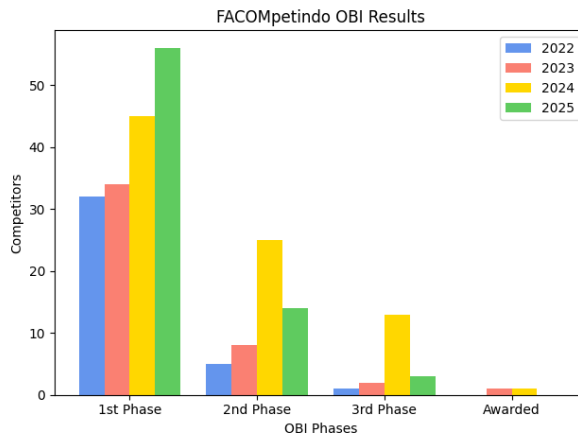


Figure 3. OBI' participation

The first phase of the MFP is conducted online, however, since 2025, the event has been held in person at FACOM for interested competitors in the region, offering an immersive environment, real-time leaderboard, snacks and prizes. That same year, FACOM had a total of 28 students registered, double the number compared to 2024, as shown in figure 5, with 12 of them competing in person.

⁸<https://codeforces.com/group/gcWlee7N7m/contest/586100/standings/groupmates>true>

The best classified student from the university in 2025 solved a total of 3 problems, finishing in 260 out of over 1000 competitors, unfortunately, in that year, we had no students classified for the final phase.

Like the MFP, the Phase Zero of the Marathon, which is traditionally held online, has been offered in-person for teams interested in this option, since 2024, thereby encouraging participation in this competition. In-person participation fosters a sense of community and belonging among students, encouraging participation, outreach, and interest [Nunes et al. 2024]. As a result, in 2024, 33 local teams (each with 3 students) registered, a 153% increase over the previous year, ranking UFMS as the 2nd university with the highest number of registered teams.

Unfortunately, in 2025, we had a reduction in the number of teams registered for Phase Zero, having about 20 teams from the university, however, all teams solved at least 1 problem, with the majority solving at least 3. In addition, a lot of teams were comprised of 3 freshmen. These facts suggest a very positive scenario for the future, showing real impacts from the project.

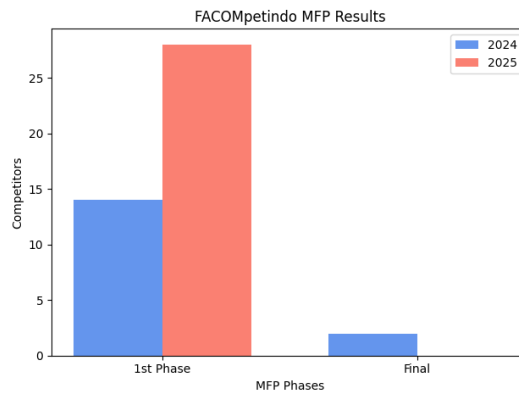


Figure 4. MFP' Participation

Also in 2025, on the First Phase of the Marathon, there were 9 teams from UFMS registered, representing an increase from 2024 and a similar amount compared to 2023. Some factors prevent this number from getting higher like in the other competitions, the biggest one is the fact that this competition has a registration fee, despite this usually being covered by the university, it isn't always. Likewise, the First Phase is disputed in teams of 3, in contrast from the OBI and MFP, this make some students not being able to participate by not knowing other interested students.

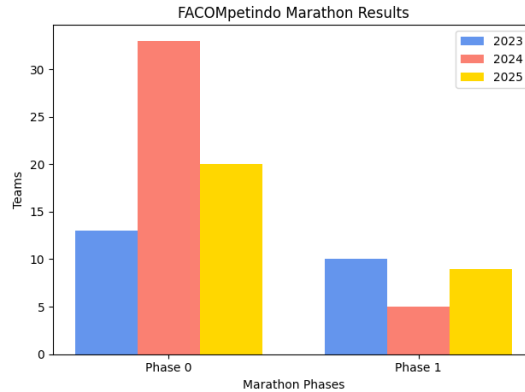


Figure 5. 0 and 1st phase' participation in the Programming Marathon

Because of the number of participating institutions being low, our region has a single slot for the Brazilian Final Phase of the Programming Marathon, consecutively, in the last six years, it has been always a team from UFMS that classifies.

4. Participants' Feedback

In total, during the trainings of the first semester of 2025, 92 different people participated in at least one day of training, with an especially high participation in the first days, that diminished in the passing of the semester, but always maintaining a base of present and interested students.

After the ending of the trainings, a feedback form was created, with various questions made to measure the impact, high and low points and the vision of the participants about the classes. A total of 15 answers were collected, representing approximately 16% of all attendees.

Of the 16 respondents, 13 are in their first semester, 1 is in their third semester, and 1 is in their fifth semester. Furthermore, 76.3% are male and 26.7% are female. Regarding their course of study, 46.7% are studying Software Engineering, 33.3% are studying Computer Science, 13.3% are studying Computer Engineering, and 6.7% are studying Information Systems.

Firstly, the participants were presented with the sentences shown in Figures 6 and 7, indicating that the suggested problems are a good complement to the in-person classes.

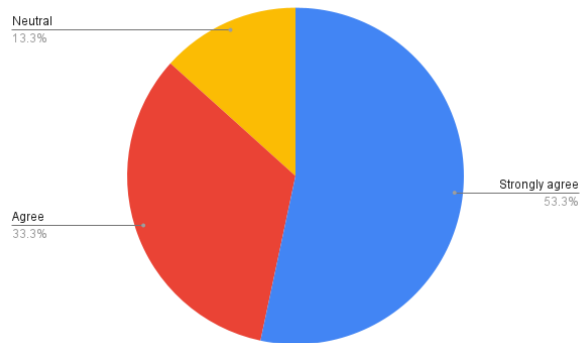


Figure 6. Sentence: "You feel more prepared to solve programming exercises due to your participation on the training."

Two sentences about the training spreadsheet were presented, as shown in Figures 8 e 9, suggesting that this resource boosts participation and strengthens learning.

The sentence "Participation in the training motivated you to participate in one or more programming competitions (MFP, OBI, Phase Zero Marathon)" received 100% "Strongly agree" responses. Additionally, when asked if they formed teams and/or studied with colleagues because of the training, 73.3% of students indicated yes, while 26.7% indicated no. In contrast, when asked about their expectations regarding the Marathon, Figure 10 shows the results, suggesting that students developed an interest in participating

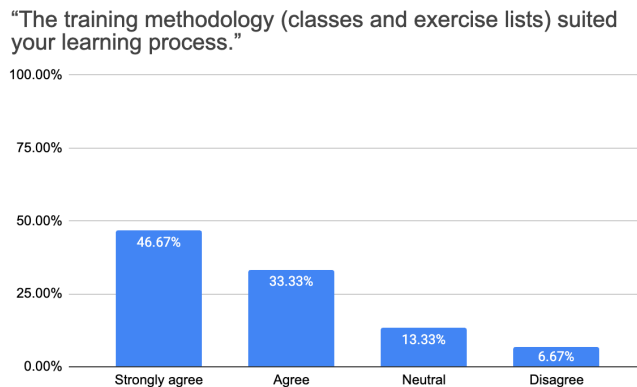


Figure 7. Sentence: "The training methodology (classes and exercise lists) suited your learning process."

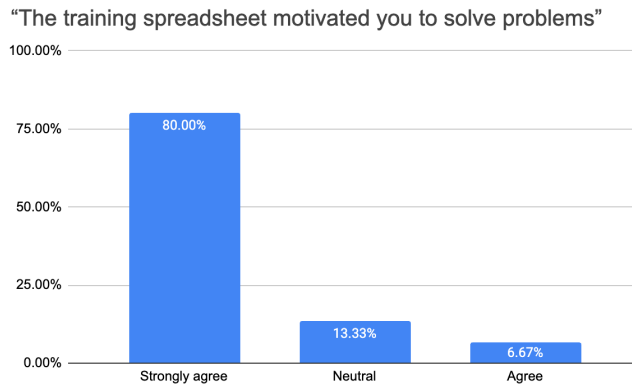


Figure 8. Sentence: “The training spreadsheet motivated you to solve problems“

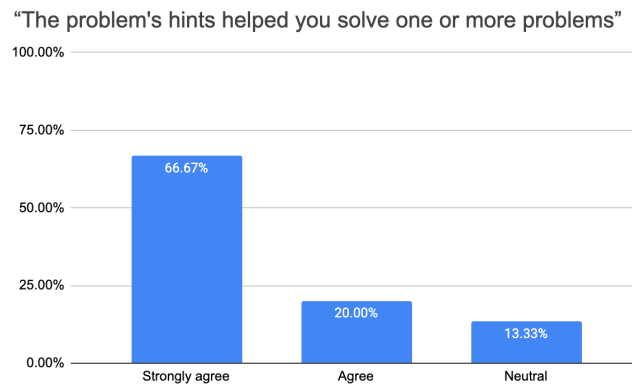


Figure 9. Sentence: “The problem’s hints helped you solve one or more problems“

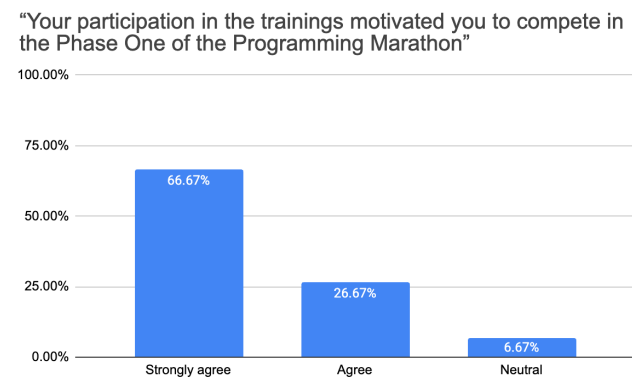


Figure 10. Sentence: “Your participation in the trainings motivated you to compete in the Phase One of the Programming Marathon“

in the competitions and many formed friendships and/or groups in this context, but the Phase One presents a greater challenge.

Both the questions "Would you like more competition simulations during training?" and "Would you recommend the training to other colleagues?" received 100% positive responses. Participants recommended the creation of additional materials, such as complete written solutions to exercises and class summaries when asked. Finally, in response to the question "What was the biggest difficulty you faced trying to participate in the training?", 6 (37.5%) students pointed to the training schedule, 4 (25%) chose the C++ programming language, and 6 (37.5%) cited the difficulty of balancing it with their university studies.

5. Conclusion

This article presented the methodology and results of the competitive programming training conducted by the FACOMpetindo group in the first semester of 2025. Overall, the participation and performance of FACOM students has never been higher, with several participation records broken and numerous students engaged. The significant participation of Software Engineering students is a new development which emerged in 2025, showing that more and more new people are being impacted. Also, the creation of supplementary materials such as spreadsheets, tips, and slides reinforces and further encourages the participation of these students. In the future, the training will continue to be implemented, considering the suggested changes.

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He has been actively involved in competitive programming both as a contestant and as an organizer of events, and currently serves as a member of the Problem Setting team of MFP (Maratona Feminina de Programação), an important competition in Brazil.



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Erick Ribeiro is a Computer Engineering student at UFMS (*Universidade Federal do Mato Grosso do Sul*), who is involved in competitive programming by organizing training for freshmen, creating materials and teaching classes in the FACOMpetindo project, in addition to having participated in the ICPC twice, in the ICPC Summer School at Unicamp, and having won a bronze medal at the OBI in 2019.



Mariana G. Ramires is a Computer Science student at UFMS (*Universidade Federal do Mato Grosso do Sul*). Her research focuses on Artificial Intelligence in Law and Fairness in Machine Learning. Beyond her academic work, she is an active member of the FACOMpetindo community, contributing as both a competitor and an organizer, with a dedicated interest in female and other underrepresented genders participation in competitive programming.



Matheus Amorim is a Computer Engineering student at UFMS (*Universidade Federal do Mato Grosso do Sul*). As a competitor, he participated in two National Programming Marathon Finals (ICPC). In addition to competing, he is actively involved in the development of the local community, teaching and training other students on algorithms in the FACOMpetindo project.



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