The UNO Fact Book

Problem-Solving: Why?

"Problems are to the mind what exercise is to the muscles: they toughen and make strong."

Norman Vincent Peale

"No problem can stand the assault of sustained thinking."

Voltaire

"It's not that I'm so smart, it's just that I stay with problems longer."

Albert Einstein.

"Problems cannot be solved at the same level of awareness that created them."

Albert Einstein

"Life is a continuous exercise in creative problem solving."

Michael J. Gelb

What is UNO?

UNO (the UTSA Number Olympics) is a problem-solving competition organized by the Department of Mathematics of the University of Texas at San Antonio.

UNO is partly funded by a Tensor-SUMMA grant (http://www.maa.org/programs/tensor-summa.html) from the Mathematical Association of America (MAA: http://www.maa.org/)

UNO has two categories:

- **UNitO,** open to San Antonio area high-school students.
- **UNOte,** open to UTSA undergraduate students.

UNO is meant to provide a venue for friendly academic competition. **UNO** challenges students to apply their knowledge and expertise in solving math problems. **UNO** does not foster pure memorization, rote drilling, "speed math", or the use of calculators. Instead, **UNO** seeks to promote an approach to learning and applying knowledge that is consistent with the professional demands of a career in science, engineering, medicine, finance, and practically any other area.

UNitO problems are multiple-choice and mimic the content and scope of AMC 12 exams.

UNitO tip: ***UNitO*** *is excellent practice in preparation to take the AMC 12 exam.*

UNOte problems are inspired by those in the Putnam Competition. They require essay-style answers and occasionally need more advanced mathematical knowledge (calculus, linear algebra, or differential equations).

What is the AMC?

The *American Mathematics Competitions* (AMC: http://www.unl.edu/amc/) are several USA-wide contests organized by the MAA. They include

- The AMC 8 (for students up to 8th grade).
- The AMC 10 (for students up to 10th grade).
- The AMC 12 (for students up to 12th grade).

A small percentage of the top-scoring students in the AMC 10 and AMC 12 are invited to take the *American Invitational Mathematics Examination* (AIME). Approximately 500 of the top-scoring AIME contestants are eligible to participate in the *USA Mathematics Olympiad* (USAMO). The top twelve scorers in the USAMO receive intensive training and take a final selection exam to determine the team of six students that represents the USA in the *International Mathematics Olympiad* (IMO) every year.

The AMC 12 exam consists of 25 multiple-choice problems (in 75 minutes) that can be solved using only elementary mathematics, up to trigonometry and pre-calculus. However, most of the problems still involve only basic concepts, such as arithmetic, algebra and geometry. Solutions typically require significant ingenuity well beyond the demands of standard textbook exercises.

UNitO tip: *Talk to your math teacher about registering to take the AMC 10 or AMC 12 contests. Early registration is necessary. (The exams take place in February).*
You can even choose to take the test in English, español or français! (But you need to request the materials in the proper language when you register.)

What is the Putnam Exam?

The William Lowell Putnam Mathematical Competition (http://math.scu.edu/putnam/) is a problem-solving contest organized by the MAA and open to undergraduate students in the USA and Canada. It is held on the first Saturday of December every year. The exam consists of two 3-hour sessions (morning and afternoon), with six problems in each session. These problems are similar to the ones in the USAMO and IMO, with an important difference: they cover not only elementary mathematics, but also some college-level math (such as calculus, differential equations, and linear algebra). Still, the solutions to many if not most Putnam problems require only high-school mathematics.

As in the USAMO and IMO, the Putnam problems require essay-style solutions. The names of the top 500 contestants are disseminated nation-wide, and the top scorers receive cash prizes and scholarships.

UNOte tip: *While any undergraduate student is eligible to enter the Putnam Competition, only the top three students of an institution form part of the school's "official" team. The 3-student UTSA Putnam team will consist of* ***UNOte****'s highest scorers.*

What is the UTSA Problem-Solving Seminar?

The problem-solving seminar is a venue for students to learn problem-solving techniques and apply them to the solution of interesting and challenging problems. Currently, UTSA undergraduate students can participate in the seminar by enrolling in MAT 4953 (and earn credit for this course—it's like having your cake and eating it, too!)

Under the terms of the Tensor-SUMMA grant the problem-solving seminar is also open to participation by local high-school students. *Yes! Open to any and all students!* However, we wish to *especially* encourage participation by students from groups that have been historically underrepresented both in AMC competitions and in careers in math and science.

If you are a student who enjoyed **UNitO** and you wish to hone your problem-solving skills (and I really hope you are planning on taking the AMC 10 or AMC 12!), you are more than welcome to join our **relaxed**, **friendly**, and **snacks-included** problem-solving discussions every Friday this fall, from 4 to 8 PM, in room HSS 3.02.30. You are also invited to do the "whole enchilada" by taking MAT 4953 next spring—and you *can* earn college credit for it!

UNO tip: *Tomorrow's best and brightest San Antonians will all be alumni of the problem-solving seminar—guaranteed. Whether a high-school or college student, join the problem-solving seminar* **pero ya**[*]*!!!*

[*] Translation of "***pero ya***": immediately, already, soon, fast, pronto, rápido, déjà, vite, schon, bald, …. Just do it!

What is a Tensor-SUMMA grant?

The *Tensor Foundation* has provided funding for the MAA to award grants for programs designed to encourage pursuit and enjoyment of mathematics among middle school students, high school students, and/or beginning college students from groups traditionally under-represented in the field of mathematics. The name of the program is *Strengthening Underrepresented Minority Mathematics Achievement* (SUMMA).

Prof. Eduardo Dueñez is the leader of UTSA's Tensor-SUMMA project, which includes the following activities:

- Support for the problem-solving seminar MAT 4953.
    - Provide a collection of reference books on problem solving topics.
    - Provide snacks for the informal Friday office hours.
- Recruiting efforts to involve high-school and early college students in the problem-solving seminar.
- Organizing the **UNO** competition, providing prizes, and encouraging students to participate in the AMC and Putnam contests.
- Mentoring for participants in the problem seminar.
- Bringing to UTSA invited speakers who have distinguished themselves in competitions.
- Endowing book prizes for San Antonio minority high-school students with demonstrated potential for academic achievement in math and science.

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