

***The Tenth  
Annual***

**North  
American  
Computational  
Linguistics  
Olympiad**

**2016**

**[www.nacloweb.org](http://www.nacloweb.org)**

# **2016 Student Handbook**

**Version 1.02, September 6, 2015**

**Check the web site for updates**

**2016 Contest Dates**

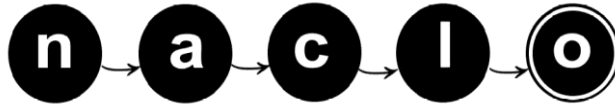
Open Round: January 28, 2016

Invitational Round: March 10, 2016

Regular registration deadline: January 14, 2016 (recommended)

Late registration deadline: January 27, 2016 (**noon PST**, if space available)

Walk-ins are allowed with advance permission of the local site host



## **ABOUT**

### **Introduction**

NACLO is a fun (and educational!) contest for U.S. and Canadian high school students in which contestants compete by solving compelling and creative puzzles in linguistics and computational linguistics. Requiring no previous knowledge of linguistics, languages, or computing, these puzzles can be solved by analytic reasoning alone, and serve as a fun introduction to a field to which many high school students have never been introduced. Winners of NACLO are eligible to compete in the International Linguistics Olympiad, one of twelve international high school science Olympiads.

### **Contact**

[naclo16org@umich.edu](mailto:naclo16org@umich.edu)

### **What's New in 2016?**

As of the writing of this version of the handbook, there have been no changes to the contest logistics compared with 2015.

## **HOW TO PARTICIPATE**

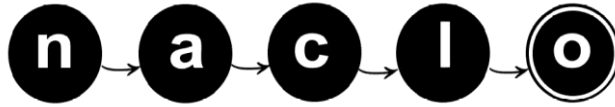
### **University sites**

Many universities provide an exam room and volunteers to facilitate NACLO. The list of available locations as of publication of this document is on Page 4, and an updated list is available on the [NACLO web site](#). Registration is available [online](#). Students must enter the name of their high school and the name of a teacher or parent who will be responsible for taking them to the university site.

Each university site will contact registered students with directions and other important information about the day of the contest.

Schools that are sending several students to a university site may want to hire a school bus. If the school is not providing a school bus, students will need to arrange their own transportation with the help of their parents and teachers.

Some universities may use the contest as an opportunity to reach out to students who are interested in studying linguistics or computer science. They may provide information on careers in linguistics and language technologies and how you can study linguistics and language technologies in college.



## **High School sites**

Students who cannot or choose not to participate at a university site can participate at their own school.

In order to participate at school, students should ensure that a teacher at their school will serve as a site facilitator, is aware of the rules of the contest and will supervise them on contest day. For more information about serving as a site facilitator, visit the Facilitator Handbook.

## **Student Eligibility**

*To participate in NACLO, you must satisfy all of the following criteria:*

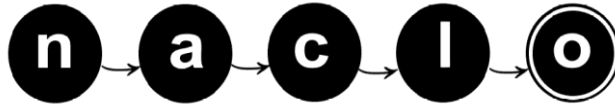
- You have never been enrolled as a full-time college or university student.
- You will be less than 21 years old on the date of the invitational round of the NACLO.
- You are a citizen of the US or Canada or a student in a secondary school in the US or Canada.
- You are available to take the test at one of the times it's offered.
- You can either take the test at a registered university site or find a teacher or librarian who can run a high school site as specified elsewhere.

*To be eligible for the Canadian ILO team, you must:*

- Be eligible for and participate in NACLO.
- Renounce your eligibility for every other country's ILO team for the current year.
- Be a citizen of Canada or a student in a Canadian secondary school, and provide proof if asked.

*To be eligible for the US ILO team, you must:*

- Be eligible for and participate in NACLO.
- Be a citizen of the US or a student in a US secondary school, and provide proof if asked.



## **University Locations (as of September 6, 2015)**

The following universities are expected to host NACLO sites in 2016. Additional locations and possible cancellations will be posted on the [web site](#).

### **Canada**

#### **AB**

University of Alberta (Edmonton)  
University of Lethbridge (Lethbridge)

#### **BC**

Simon Fraser University (Burnaby)  
University of British Columbia (Vancouver)

#### **NS**

Dalhousie University (Halifax)

#### **ON**

University of Ottawa (Ottawa)  
University of Toronto (Toronto)  
University of Western Ontario (London)

#### **QC**

McGill University (Montreal)

### **United States**

#### **AL**

University of Alabama – Birmingham  
(Birmingham)

#### **CA**

San Diego State University (San Diego)  
San Jose State University (San Jose)  
Stanford University (Stanford)  
University of Southern California, ISI  
Campus (Marina del Rey)

#### **CO**

University of Colorado (Boulder)

#### **CT**

Central Connecticut State University (New  
Britain)  
Yale University (New Haven)

#### **DC**

Georgetown University (Washington DC)

#### **GA**

Emory University (Atlanta)

#### **IL**

Northeastern Illinois University (Chicago)

University of Illinois (Urbana-Champaign)

#### **IN**

Goshen College (Goshen)  
Indiana University (Bloomington)  
University of Notre Dame (South Bend)

#### **MA**

Brandeis University (Waltham)  
Massachusetts Institute of Technology  
(Cambridge)

#### **MD**

Johns Hopkins University (Baltimore)  
University of Maryland (College Park)

#### **ME**

University of Maine (Orono)

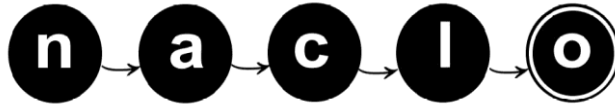
#### **MI**

University of Michigan (Ann Arbor)  
Western Michigan University (Kalamazoo)

#### **MN**

Bemidji State University (Bemidji)  
Minnesota State University (Mankato)

#### **NC**



University of North Carolina - Charlotte  
(Charlotte)

**NH**

Dartmouth College (Hanover)

**NJ**

Princeton University (Princeton)

**NY**

Columbia University (New York)

Cornell University (Ithaca)

Stony Brook University (Stony Brook)

Union College (Schenectady)

University of Rochester (Rochester)

**OH**

Ohio State University (Columbus)

**PA**

Carnegie Mellon University (Pittsburgh)

University of Pennsylvania (Philadelphia)

**TN**

Middle Tennessee State University  
(Murfreesboro)

University of Memphis (Memphis)

**TX**

University of Houston (Houston)

University of North Texas (Denton)

University of Texas (Austin)

University of Texas at Dallas (Dallas)

**UT**

Brigham Young University (Provo)

University of Utah (Salt Lake City)

**VA**

College of William and Mary (Williamsburg)

**WA**

University of Washington (Seattle)

Western Washington University  
(Bellingham)

**WI**

University of Wisconsin (Madison)

University of Wisconsin Eau Claire (Eau  
Claire)

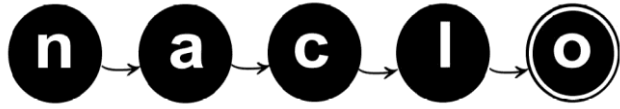
University of Wisconsin Milwaukee  
(Milwaukee)

## High School Locations

More than 100 high schools held the contest on site in 2015. If your high school wants to participate in 2016, you and your teacher need to register. First, ensure that your high school has been registered as a host site. If not, have your teacher register it for you [here](#). Then, your teacher should register as a High School Host [here](#). If your teacher has questions about what is involved with serving as a coordinator, they can visit our Coordinator Handbook. You can register to participate [here](#).

## Home Schooled Students

If you are home schooled (according to the official rules of your state or province), you can still register for NACLO. Parents should go to the NACLO website teacher registration page (the main NACLO website under “High School Site Coordination”) and register themselves as a teacher. Once you get to the “school” option you can select “home school” from the drop down menu. Once you have registered as a teacher you will be able to register your student on the student registration page (The main NACLO website under “Student Registration”).



## **BEFORE THE CONTEST**

### **Training Sessions**

Some universities or high schools may provide training sessions for students in their area. These are not required for participation in NACLO and not all participating sites provide them. The training sessions may include problem solving practices, an overview of linguistics and computational linguistics, and ideas about careers in linguistics and computational linguistics.

Training sessions may be done in the evening at a university or during the school day at your school. If you are near a university that is hosting NACLO, you can check if it will have a training session by sending email to the contact person for that university listed on the web site.

If you are not near a university that is hosting NACLO, send email to [nacl16org@umich.edu](mailto:nacl16org@umich.edu). We will try to work something out for you; we may find a computational linguist in your area, send you some materials from other sites, or just make sure that you have a supply of practice problems and readings.

A typical training session lasts from one to two hours. Some of the time is for a presentation and group problem solving. Other activities could include coming up with new problems, etc.

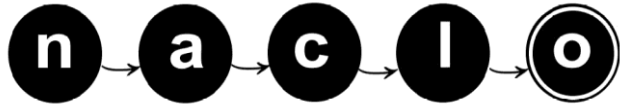
### **Special needs**

If you have special needs, please notify the contest organizers **as soon as possible**, and they will try to accommodate you. You should discuss all your special needs **before the contest**.

## **What Happens on Contest Day?**

### **Students participating at a university**

If you are coming from your school by school bus or van, your teacher will tell you what time you will be leaving. If you arrange your own transportation, you should arrive at the university site at least 45 minutes before starting time so that you have time to check in, get seated, use the bathroom, etc. Typically, seating will be at 20 minutes before the starting time, and the rules will be read at 15 minutes before the starting time. The contest booklets will be handed out at the designated starting time, and the facilitator at the university will tell you when to start working on the problems.



### **Students participating at a high school**

Your teacher will give you the contest location. Make sure to be there before the starting time. Typically, seating will occur at 20 minutes before the starting time, and the rules will be read at 15 minutes before the starting time. The contest booklets will be handed out at the designated starting time, and your teacher will tell you when to start working on the problems.

## **Other Contest Rules**

### **Open Round**

The open round is open to all interested middle school and high school students; its purpose is to identify strong contestants who will advance to the Invitational Round.

### **Invitational Round**

The problems in this round are harder than the Open Round problems. The purpose is to select national winners, who will be eligible to participate in the international competition, The International Linguistics Olympiad (ILO).

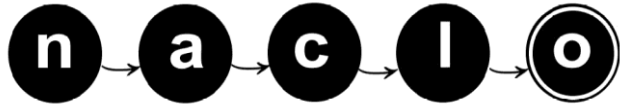
### **Problems and solutions**

The Open Round is typically three hours long, whereas the Invitational Round is typically four hours long. The judges have the authority to lengthen either competition in the event of unforeseen circumstances.

Students should submit all their solutions in writing, using a *black pen*, only in the space provided and ensure that their handwriting is legible. The use of a black pen is essential to ensure legible photocopying or scanning of the solutions, which may be done to streamline the grading process.

Students are allowed to use extra blank paper; however, there should never be answers to more than one question on a single sheet of paper. Extra paper should be scanned together with the booklet. The answers will be split by problem number and shipped to graders around the world. Students should write only on one side of the papers so that these pages can be scanned if needed. Furthermore, students may not take any booklets or scratch paper with them when they leave the site.

Students may solve the given problems in any order, and should try to solve as many problems as possible. You are not penalized for incorrect answers. Some problems (mostly on the Invitational round) **may** include "practice" (explanations) and "theory" questions; the practice sections are worth



approximately 60% of the score, and the theory sections are worth approximately 40%. Students may receive partial credit for providing an incomplete solution to a problem, and/or partial credit for specific ideas for solving it. Thus, if they have ideas for solving a problem, they should write them even if they have not been able to develop a complete solution. In other words, students should be encouraged to show their work and/or thought process when solving these problem.

Given the large number of expected participants in the first round, most or all of the problems in that round will not require a “theory” part. Instead, the answers will be automatically gradeable. "Blue," "17", "1A, 2D, 3D, 4E, 5C", "nihuetzi," and "A>C>G>F>B>E>D" are fine answers. The problem booklets will be designed to include an answer sheet.

### **Allowed and disallowed materials**

Students should bring their own pens and pencils. Students are **not** allowed to bring their own paper. The facilitators will provide all paper needed.

Participants should write their solutions in black ink, and may use pencils only for scratch work. They may use blank paper for scratch work; however, they should copy their final solutions into the spaces provided in the problem booklet, and they may enclose additional sheets only if the space in the booklet is insufficient. Scratch paper is to be handed in with the answer booklet, but kept separate from it.

Students may not use any electronic devices except basic wristwatches. In particular, they may not use calculators, computers, tablets, cell phones, pagers, or wristwatches with built-in calculators. Attempts to use electronic devices will normally lead to disqualification. If a student has any medical electronic devices, required for health reasons, he or she should let the facilitators know before the contest.

Participants may not use any written or printed materials such as books or their own notes produced before the contest.

### **Conduct during the contest**

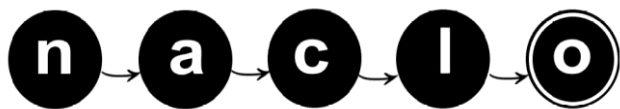
Students should follow all instructions of the facilitators; if they have questions about the rules or acceptable conduct during the contest, they should raise their hand and ask a facilitator.

Students may not talk with anyone except facilitators, and may not collaborate with other contestants. Attempts to communicate with other contestants will normally lead to disqualification.

Bags should be placed under the seats before the contest, and may not be used during the contest. If students have brought snacks, these should be placed on the desk before the contest begins.

If a student has a cell phone, pager, or any other sound-emitting device in his or her bag, he or she should turn it off before the contest. Just switching it to vibrate or silent mode is not sufficient.





Participants may take bathroom breaks during the contest; however, they may not take their bags, any electronic devices, problem booklets, or their notes with them when temporarily leaving the room. Also, two contestants may not take a bathroom break at the same time.

Unless the local facilitator overrides this rule (e.g., due to university or high school regulations), students may bring a snack into the contest site and eat during the contest, but they should be considerate of others. In particular, they should avoid "noisy" foods, such as foil-wrapped chocolates, and foods with a strong odor. The facilitators have the authority to remove any types of food from the contest site if they feel that these types of food may distract other contestants. Noisy wrappers should be opened before the contest begins.

If students arrive late, they may still participate in the contest; however they may not ask facilitators to repeat any instructions or announcements that have been missed. Also, they may not ask for time extensions in the end of the contest, which means that they will have less time than the other contestants.

### **Questions during the contest**

If a student has a question, he or she needs to raise a hand, and one of the facilitators will talk with him/her. When talking with a facilitator, students should keep their voices low, to make sure that they do not distract other contestants and do not accidentally provide a hint for solving the problem.

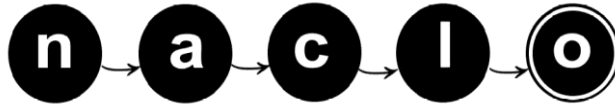
If a student needs a clarification for a specific problem, the facilitator will need to contact the judges via email, which means that an immediate answer may not be available. Please note that local facilitators are unable to answer student questions without contacting the judges. If the judges agree that the problem requires a clarification or correction, they will normally announce it to all site facilitators via email.

If the judges feel that an answer is already contained in the booklet, or that attempting to give a student an answer may give someone an unwanted hint, they may refuse to answer the question by telling the student that they are unable to answer the question.

### **Scoring**

Every problem will be worth a specified number of points; harder problems are generally worth more points.

The judges will score each solution based on its correctness, quality, and clarity, and determine the overall score as the sum of solution scores. The judges will complete the scoring and announce the results (ideally, within three to six weeks after the competition).



*The judges are solely responsible for scoring the solutions, ruling on unforeseen situations, and selecting the winners; their decisions are final.*

## **FREQUENTLY ASKED QUESTIONS**

### **How does a student register for the competition?**

The competition is intended for students in the 13-18 age group. If you are younger than 13, with parental permission, you can also participate. In this case, please **do not register online**. Instead, ask your parents to contact [nacl16org@umich.edu](mailto:nacl16org@umich.edu) directly.

You should register through the NACLO web site ([www.nacloweb.org](http://www.nacloweb.org)). The registration form is located by clicking on the “student” tab. In the registration form, you must choose one of three options regarding where you will be participating:

- Choose **High School Site** if you plan to participate at your high school. This involves having a teacher or administrator supervise the contest at your school. This person should carefully review the facilitator responsibilities listed in the relevant handbook.

OR

- Choose **University Site** if you plan to participate at a NACLO university site. This involves going to the university to take the test. If your city has a university site, we encourage you to participate at this site. An up to date list of university sites is available at on the NACLO web site.

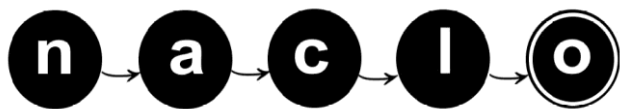
OR

- If you are home schooled, you can still register! Ask your parent to register according to the instructions for home school sites earlier in this document.

### **How long is the competition?**

The Open Round will be three hours long; however, note that the judges have the authority to lengthen it in the event of unforeseen circumstances. The start time of the Open Round depends on the time zone. Time zones not listed below should make special arrangements with the organizers in advance.

<i>Time for the <b>Open Round</b></i>	<i>Start</i>	<i>End</i>
Pacific	9:00am	12:00noon
Mountain	10:00am	1:00pm



Central	9:00am	12:00noon
Eastern	10:00am	1:00pm
Atlantic	11:00am	2:00pm

The start times shown here are when students can work on the problems. Registration and other administrative activities happen earlier. Try to be at your site 45 minutes prior to the designated start time.

The Invitational Round will be four hours long. The contest will start at 9 AM in all time zones except the Atlantic Time Zone.

<i>Time for the Invitational Round</i>	<i>Start</i>	<i>End</i>
Pacific	9:00am	1:00pm
Mountain	9:00am	1:00pm
Central	9:00am	1:00pm
Eastern	9:00am	1:00pm
Atlantic	10:00am	2:00pm

### **Can younger students (e.g., middle school students) participate?**

Yes, they can. In fact, we will award a special certificate to the top students who participate in the 8<sup>th</sup> grade or below. Students younger than 13 should see our special registration instructions above.

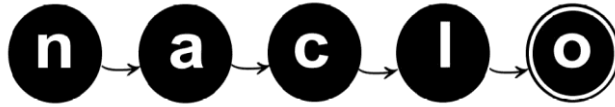
### **How many problems should I expect?**

You should expect 5-8 problems during the Open Round and 6-10 (generally harder) problems in the Invitational Round.

### **What problem types should I expect?**

You may encounter the following problem types; however, this list is not exhaustive, and you may also get problems of other types. The problems will contain all information required for solving them, and you do not need any specialized linguistic knowledge.

- *Translation problems:* A problem includes a set of sentences in a foreign language and their translations into English, which may be in order or out of order. Your task is to learn as much as possible from these translations and then translate other given sentences to or from English. Note that the foreign language may have "tricky" structure and grammar. For example, German sentences often end in verbs. Japanese people talk differently about their family and about someone else's family. Some languages do not use articles or any equivalent of "to be." Others



treat animate and inanimate objects differently. Be prepared to figure out these unfamiliar features from the text.

- *Number problems:* A problem includes foreign sentences that describe basic arithmetic facts, such as "six times four is twenty-four," and your task is to figure out how to translate different numbers and expressions. Some languages use bases other than ten; others use different words for the same number depending on the objects being counted, etc.
- *Writing systems:* Your task is to figure out how a particular writing system works and then use it to write out a given text, such as an ancient inscription. Some languages are written right to left or top to bottom, others do not use vowels, etc.
- *Calendar systems:* Your task is to figure out what calendar was used by a particular civilization based on sentences that refer to it.
- *Formal problems:* In this context, "formal" means that you have to build a logical model of a language phenomenon. For example, a transformation rule may say "to convert an active voice sentence to passive voice, make the object of the former sentence the subject of the latter one, convert the verb to passive by using an appropriate form of the verb "to be" with the past participle of the verb, and add "by" before the word that was the subject of the former sentence." If we apply this rule to "Maya ate an apple," we get "An apple was eaten by Maya."
- *Phonological problems:* Your task is to figure out the relationship between the sounds of a language and its writing system.
- *Computational problems:* Your task is to develop a procedure to perform a particular linguistic task in a way that can be carried out by a computer.
- *Other types:* Deciphering kinship systems, transcribing spoken dialogue, associating sentences with images, translating unknown languages from scratch, and many other types of problems.

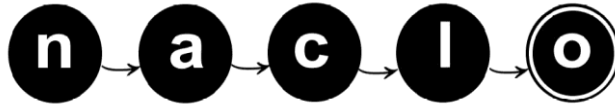
### **Where can I find example problems and related reading materials?**

You may find some [reading materials](#) on the NACLO website; note that these readings are not required for participation. You may also find more than 200+ past problems on the main website under "[Practice Problems](#)."

You may find even more problems by searching the web for "ILO" or "*linguistics olympiad*," where "ILO" stands for "International Linguistics Olympiad."

### **What knowledge and skills do I need?**

You mostly need logical thinking, as well as basic general knowledge, such as about arithmetic and standard calendars. You do not need prior knowledge of linguistics, computer science, programming, or foreign languages.



### **How many people participate in NACLO?**

Recently, 1,700+ students have been participating yearly at 100+ high school sites and about 50 university sites.

### **What happens if I do well?**

If you earn a high score at the Open Round, you will advance to the Invitational Round. You will be notified if you are invited to participate in the Invitational Round. The top scorers in the Invitational Round will be invited to an online practice program. The top-scoring four US students and the top-scoring four Canadian students in the Invitational Round will be chosen to represent the United States and Canada at the International Linguistics Olympiad. Additionally, four more top-scoring US students on an as-yet undetermined combination of the Open Round and Invitational Round may be invited as a second team to represent the United States at the International Linguistics Olympiad.

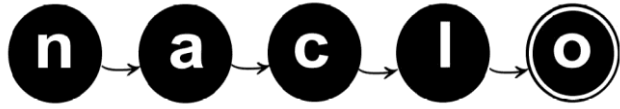
### **If I advance to the International Linguistics Olympiad, will I have to pay for my trip?**

We are working on the funding for participating in the international competition, and we will probably be able to provide funding for all teams; at the very least, the top team of the United States will have full funding. If you are a member of a team that does not have full funding from NACLO, you would need to pay for your trip.

### **How well did the United States teams do at the IOL in 2007-2015?**

In 2007, the United States participated in the International Linguistics Olympiad for the first time. The top US team tied for first place; furthermore, one of the US contestants, Adam Hesterberg, earned the highest score in the individual contest and won one of two "first diplomas." In 2008, the top US team tied for the first/second place, and the second team tied for the third/fourth place. Furthermore, US contestant Hanzhi Zhu received one of the three gold medals; two US contestants (Morris Alper and Anand Natarajan) received silver medals; and three contestants (Rebecca Jacobs, Jeffrey Lim, and Guy Tabachnick) received bronze medals. The 2009 team earned two silver medals (Rebecca Jacobs and Alan Huang) and four bronzes plus a team gold. In 2010, the team earned the most awards ever – a gold medal (Ben Sklaroff), two silvers, three bronzes in the individual contest + the team first place for the highest team score at the individual contest. In 2011, even more awards came the US team's way, including a gold medal for Morris Alper.

2012 was another very successful year with two US students (Alex Wade and Anderson Wang) getting gold medals, four others getting silver or bronze, and one of the two US teams winning the team contest. In 2013, Alex Wade won a gold medal with the highest score among all participants whereas one of the US teams (Team Red) won the team contest. In 2014, Darryl Wu won an individual gold medal, and USA Red won a team gold medal. In 2015, James Wedgwood, James Bloxham, and Kevin Yang won individual gold medals. USA Red finished in first place among all teams based on the average score in the individual contest and also finished in second place in the team event.



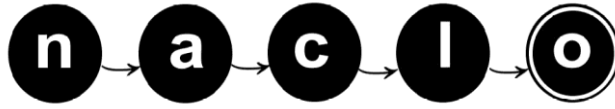
You may find more information about the results at the International Linguistics Olympiad website and the NSF press releases on the NACLO website.

### **How well did Canada do at the IOL?**

Canada participated in the ILO for the first time in 2011. The team received a bronze medal (Daniel Mitropolsky) and several other awards in 2011 and 2012. In 2013, Daniel Lovsted won a bronze medal and Stella Lau received an honorable mention. In 2014, Daniel Lovsted won an individual gold medal while the Canadian team finished in second place overall based on the average score in the individual contest. In 2015, Emma McLean received an honorable mention.

### **What if my question was not answered above?**

If you have further questions, please contact [na clo16org@umich.edu](mailto:na clo16org@umich.edu) .



## **Program Committee**

Susan Barry – Manchester Metropolitan U.  
Aleka Blackwell – Middle Tennessee State U.  
Jordan Boyd-Graber – University of Colorado  
Alan Chang – University of Chicago  
Yejin Choi – University of Washington  
Lynn Clark – University of Canterbury  
Dorottya Demszky – Princeton University  
Jason Eisner – Johns Hopkins University  
Caroline Ellison – Stanford University  
Michael Erlewine – National U. of Singapore  
Josh Falk – University of Chicago  
Harry Go – WUSTL  
Lars Hellan – Norwegian Inst. of Sci. and Tech .  
Adam Hesterberg – MIT  
Jordan Ho – University of Toronto  
Dick Hudson – University College London  
Alex Iriza – Princeton University  
Wesley Jones – University of Chicago  
Greg Kondrak – University of Alberta  
Jonathan Kummerfeld – UC Berkeley  
Andrew Lamont – Indiana University  
Mary Laughren – University of Queensland  
Lori Levin – Carnegie Mellon University  
Richard Littauer  
Patrick Littell – University of British Columbia  
Daniel Lovsted – McGill University  
Jonathan May – Information Sciences Institute  
Tom McCoy – Yale  
Rachel McEnroe – University of Chicago  
David Mortensen – Carnegie Mellon University  
Babette Newsome – Aquinas College  
David Palfreyman – Zayed University  
James Pustejovsky – Brandeis University  
Dragomir Radev – University of Michigan  
Verna Rieschild – Macquarie University  
Oliver Sayeed – University of Cambridge  
Ben Sklaroff – UC Berkeley  
Harold Somers – Dublin City University  
Alex Wade – Stanford University  
Elysia Warner – University of Cambridge

## **Organizing Committee**

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