Final Report for the Ada Lovelace Birthday Bash, Made Possible with Funding From Lisa Simonyi and the IAS W+AM Program

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1. Impact Statements

Event Overview

The Ada Lovelace Birthday Bash and mini-conference was a celebration of the life of pioneer programmer Ada Lovelace and a chance for Ottawa's undergraduate and graduate students to unwind on the last day of Fall Semester. The day proved to be snowy and stormy, and only Carleton University's students could attend the 3-hour event. In the first half, attendees were treated to four talks made by women graduate students in mathematics, statistics, and data science; in the second half of the event, four games—each corresponding directly to one of the talks—were played for prizes. Our speakers were Amanda Chafee, Yuliya Nesterova, Puxin Shi, and Christiana Koebel; they presented topics in combinatorics, geometry, machine learning, and the history of mathematics.

In the second part of the event, students played individual and team prize games connected to the concepts of the talks. They raced against the called-out-numbers clock to solve through the small math puzzles of Math and Prize Bingo. They followed a trail of math clues, team against team, in search of Ada Lovelace's missing letter in Tabletop Escape. Each tested their luck against the mean learning machine of Stochastic Slots, trying to win the game of chance that modified itself to be less beatable with every audience win. And they wracked their minds trying to recall that tip-of-the-tongue factoid in playing Trivia. The event finished with popcorn and a movie, with a documentary on the life of the pioneer programmer.

First, this was an opportunity to notify undergraduate and graduate students about the W+AM program and the work of the IAS. In our post-program survey, all respondents said that they had not heard of the IAS or the W+AM program before the Ada Lovelace BB advertising. It was likewise a great medium to bring awareness of successful women taking part in furthering mathematics and an active role at the inception of computer science. Ada Lovelace's fascinating life was front and centre in the miniconference and in the advertising for the event.

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The Ada Lovelace Birthday Bash was a great opportunity to alert students to the many opportunities before them, be it the clever bi-annual student publication Notes from the Margin from StudC, the Women and Mathematics Program at the Insitute for Advanced Study taking place every spring, StudC's student activities funding, or the mountains of publications, conferences, and recordings available through MAA, the Fields Institute, and the IAS, respectively.

An activity book for the event will be emailed to all registered participants at the end of the school year. It bristles further factoids, connections, and puzzles and contains details about the IAS, W+AM program, Mathematical Association of America, the Fields Institute, and StudC, the student committee for the Canadian Math Society, all of whom sponsored the event. What follows on page 7 of this report is an excerpt from the activity book.

Academic Impact of the Event

The mini-conference invited students from various departments, including computer science, statistics, mathematics, and engineering. The difference in discipline cultures was particular apparent in the heated debate over the usefulness/detriment payoff of machine learning, following the talk by Puxin Shi. The fruitful discussion was a microcosm of that happening worldwide at various conference, as students from different fields reflect on the change the technological development has brought: for some, this bodes a useful tool that makes statistical modelling easier in the future; for others, it is a menacing ability to manufacture anything on a whim that has been freely distributed to all; while some foresee more hours spent on futile scrutiny of assignments purporting to be students' original work, others grapple with anxieties about false suspicions assigned to them over papers that sound too formulaic or predictable.

Likewise, the discussion around Pop-Up Paper Geometry introduced some computer science students to a field of mathematics they were oblivious to, and allowed them to imagine algorithmic solutions to some of the stated problems; the Mathematics of Bingo brought active learning into the mix as attendees were invited to calculate combinations on the fly and anticipate the conjectures and theorems of the bingo paradox. Finally, the talk on the life of Ada Lovelace introduced a generation of students to an adventurous and daring scientist: many had not heard of Ada Lovelace until the event's invitation.

Lastly, the Ada Lovelace Birthday Bash serves as a commendable proof-of-concept for this format. Every student talk anticipated a corresponding game and every game reinforced a student talk. Attendees were thus made participants and concepts that were presented to them an hour ago were reinforced by a hands-on demonstration (as with Stochastic Slots), a pop quiz (as with Trivia, which included questions about Ada Lovelace and the IAS), or a demonstration (the pop-ups in Tabletop Escape Room and the Math and Prize Bingo echoing the talk's combinatorics). It is well agreed in pedagogy that both spaced repetition (revisiting the same concepts within one mini-conference) and the active learning (whereby attendees could put their learning to use in solving puzzles and winning prizes. Above all, the games saw attendees have fun: they bonded and networked as they raced the clock to solve a puzzle or watched the MS Excel game evolve itself and hoped to win a prize.

Leftover non-perishable food items and unclaimed prizes were donated to March's Pi Day celebrations ($\pi - \epsilon$ day), with credit to Lisa Simonyi and the IAS Women+ and Mathematics program presented ahead of the popular interdisciplinary Pi Recitation Contest, which introduced the sponsor to a far wider audience.
At the moment of writing, a post-activity book is being prepared with further math puzzles and follow-up articles. This will serve to further reinforce these four topics in memory, and (hopefully) will make a nice memento for the attendees.

Impact on the Graduate Ambassador

Both attendees from the event and fellow speakers continue to email or catch me in the hallway to chat about topics presented at the Ada Lovelace Birthday Bash. Likewise, the games I created for this event were asked after as well: I admit to having a lot of fun and frustration designing Stochastic Slots, cutting and gluing Tabletop Escape Room, and puzzling out the puzzles for the other games.

It was also, for me, a first time organizing a full academic conference, and in the process I have built new relationships and learned the steps. Most importantly, I introduced a room full of undergraduates to the work that the Institute for Advanced Studies and, more locally, the Fields Institute do in advancing mathematics and the sciences. In the pre-conference survey, only two had heard of the IAS.

Designing the mechanics of the Tabletop Escape room afforded me a space, a reason, time, and materials to practice my papercraft math puzzles: and the Microsoft Excel game Stochastic Slots was a challenge to design, as I programmed a simple self-modifying algorithm fashioned after Donald Michie's 1961 MENACE game to play slots against students.

I am grateful to Lisa Simonyi and the IAS W+AM program for once more allowing me a space to jump to a challenge and succeed. I hope that the Ada Lovelace BB will have a small but lasting impact on the students who attended or heard about it through friends and TAs.

Registered Attendees

Not all attendees registered, and some students chose to leave early or arrive late. However, those who wanted to receive a follow-up activity book are listed below.

Yuliya Nesterova
Amanda Chafee
Sara Haroon
Christiana Koebel
Yaren Zhang
Stephen Tran
Puxin Shi
Ali Madankan
Vedaant Srivastava
Ju Hong Kim
Latasha Luo
Shawn Sun
Otto Chan
Howl Nhan
Elham Rezazadeh
Noah Grew
Charlotte Noxon
Ivan Cheung
Trae Smith
Jasmine Dean
Ramona Caprariu

Among the participants, 8 were master's students, one was a PhD student, with the rest were undergraduate students. Note that some students dropped in for parts of the event to join friends and were not officially registered and that seven people did not participate in the demographics survey due to privacy concerns at their information being recorded.

2. Excerpts from Activity Book

Thank you for your interest in the 2023 Ada Lovelace Birthday Bash. In these pages, you will find some details of the event, and later some activities and puzzles to enjoy in your time off. This event was made possible with generous funding from Lisa Simonyi and the Women+ and Mathematics program at the IAS.

Ada Lovelace was a driven and creative woman who wrote the first published computer program, envisioned the computer age, and collaborated enthusiastically. She gambled, she explored, and she learned and explored every bit of mathematics that came her way. I hope that this event (and the upcoming winter break!) will enable you to find a touch of beauty and wonder in mathematics.

Yuliya Nesterova

2024 WAM IAS Graduate Ambassador

2.1 About Women$^+$ and Mathematics (W$^+$AM) Program at the Institute for Advanced Study (IAS) in Princeton, NJ

This program takes place in May: a cohort of qualifying women in mathematics is invited to attend classes, participate in tutorials, and engage in activities at the Institute for Advanced Study in Princeton, New Jersey. This builds lasting connections, which are encouraged to continue through conference and research communication after the program ends.

Picture from my visit in 2015.

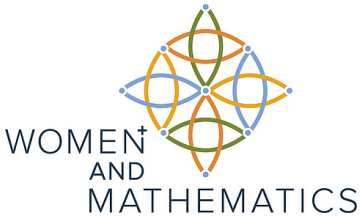
The campus boasts luxurious greenspace and beautiful trickling fountains. There is a park connected to the IAS lands: perfect for emerging from a difficult lecture and talking a long walk through the greenspace to think and reflect! There are frequent collaborations with Princeton University, a great on-campus residence, and a beautiful library.

Read more about the institute at https://www.ias.edu/.

Read more about the W$^+$AM Program, and the 2024 Theme, Symmetry and Arithmetic, on the IAS website: https://www.ias.edu/math/wam/program-years/2024.

The Institute for Advanced Study itself is a research institute. It selects 200 Members from an average of over 1500 applicants to live in Princeton , NJ, and work side-by-side with IAS colleagues. The residence period should result in significant original research.

3. We Thank Our Sponsors!



This event was made possible in part with support from Lisa Simonyi and the IAS W+AM. The Women+ and Mathematics Program welcomes bright graduate and undergraduate students to the Institute for Advanced Study every May.

The Fields Insitute funds thematic programs, seminars, outreach acitivities and conferences in our area. You can find a huge library of past lectures and seminars on their website.

StudC is the Student Committee at the Canadian Math Society. Thinking of running a student conference? Apply to their activities funding! Have a thought-provoking article to share with the world? Submit an article to Notes from the Margin!

Mathematical Association of America is the world's largest community of mathematicians, students, and enthusiasts. Its mission is to advance the understanding of mathematics. It publishes many books, periodicals, and papers geared towards undergraduate and high school audiences. Membership benefits include subscriptions to multiple publications featuring fun, engaging, and innovative puzzles and problems. Prizes include a graduate and an undegraduate year-long membership in the MAA.

4. The Talks

Amanda Chafee	`The Mathematics of Bingo`	Math and Prize Bingo
Yuliya Nesterova	`Pop-Up Paper Geometry`	Tabletop Escape Room
Puxin Shi	`Intro to Machine Learning`	Stochastic Slots
Christiana Koebel	`The Life of Ada Lovelace`	Trivia Game

Uniquely, the Ada Lovelace Birthday Bash opened students a mixture of recreation and research: each talk was accompanied by a game and every game was

4.1 The Mathematics of Bingo

Are rows and columns equally likely to be completed in Bingo? And are you sure about that? Take a journey through combinatorics to get to the bottom of the bingo paradox.
We counted the number of ways a bingo card will win on the n^{th} draw both vertically and horizontally. The odds were not always in the vertical win's favour. We then related the called numbers "shapes" to combinatorial enumeration to see how we can use functions to count in Bingo!

Math and Prize Bingo

Solve the eight mini-puzzles in your team's 3-by-3 sheet. Every 15 minutes, organizers will shout out a number that is the answer to one of your puzzles. It it's one of yours, mark that square. The undergraduate and graduate who first get Bingo both win a year of MAA membership!

4.2 Pop-Up Paper Geometry

Pop-ups have started their life as movable circles in scientific illustrations, and they're moving full-circle back into the field of science! If you have an interest in computer algorithms, a passion for geometry, or just generally you want to see things pop: this may be the hobby (or serious research project) for you!
We looked at the modern Pop-Up Paper renaissance and explored how algorithms are beginning to catch up to human ingenuity in shortening the months of frustration and trial-and-error before a pop-up is born.

TableTop Escape

Ada Lovelace's secret letter is hidden somewhere in a library. Follow the clues and find it before the time is up so the conference can proceed as planned! And yet, all is not well in the library: amidst the dusts and old thesises, monsters lurk that will befuddle and begrudge any young mathematicians who dare tread these halls. Solve the puzzles, find the secret letter, and win the grand prize!

4.3 Intro of Machine Learning

We wouldn't be honouring a great pioneer of programming and visionary of the computer age without addressing today's machine learning and artificial intelligence innovations. Dip your toe in the data science as we get a gentle introduction to the world of ML.
In the era of big data, machine learning algorithms have emerged as indispensable tools, revolutionizing our approach to problem-solving and decision-making. This presentation aims to provide a short introduction to this dynamic field, exploring its practical implementations in the real world, fundamental concepts, categories, and the process of evaluating classifiers.

Stochastic Slots

Play against a self-teaching machine and (try to) win! Stochastic slots is a mean ol' game: the more you play, the less your chances of winning. That is, it shifts the mean to give lesser weight to past human wins. It's easy to design your own Mean Stochastic Slots: all you need are some pictures, a cdf, and Index(), match(), and rand() functions in Excel. Try it yourself!
Stochastic slots was inspired by MENACE, the Machine Educable Noughts And Crosses Engine. Play tic-tac-toe against it yourself at this link! But, careful: the more you play, the less likely you are to win. In fact, you don't need a computer: all you need are 304 matchboxes and some coloured beads. There are videos of MENACE in action on the internet.

4.4 The Life of Ada Lovelace

Ada Lovelace, daughter of the famous daughter of the famous poet Lord Byron, is considered to be the first computer programmer. She was an English mathematician, known for her work on Charles Babbage's Analytical Engine. She was the first to recognize that the machine had applications beyond pure calculation: the potential of a "computing machine" and published the first algorithm intended to be carried out by such a machine.
Blending creativity with education, Ada Lovelace was both a pioneer programmer and a portender of the computer age. She also was a gambler, so two of our talks today will delve into the games of chance. More than that, she was a determined visionary, an avid explorer of all mathematics that crossed her path. We hope that you find something in these pages to inspire you to delve deeper into the thorny, maddening, surprising world of math, statistics, and data-and-computer science.

Trivia!

You know more than you believe: these questions about math & famous mathematicians! Split into teams, answer the clues, win prizes.

4.5 Summary of Expenses

Ada Lovelace Birthday Bash Budget

INCOME				
Lisa Simonyi and the Institute for Advanced Study (award, $500 USD)		$660.00		
StudC Student Activities Funding, Canadian Math Society		$220.00		
Fields Insitute Funding		$300.00		
Mathematical Association of America: 2 free yearly subsriptions		$0.00		
	TOTAL INCOME:	$1,180.00		
EXPENSES	**TOTAL EXPENSES:**	$811.47		
Social Event Overhead Costs			**$134.16**	**subtotal**
Room Booking		$0.00		
Juice and pop drinks. Cups		$26.08		
Fruit, nuts, pretzels		$28.20		
Cookies, Cupcakes, Biscuits		$39.46		
Bags, containers, cups		$13.30		
Plates and Napkins Costs		n/a		
Popcorn		$27.12		
Travel and Parking Costs			**$85.79**	**subtotal**
Parking for Speaker		$18.00		
Gas money for delivery/pick-up of prizes, food, and speaker		$67.79		
Materials Costs (creating Tabletop Esccape Room and Stochastic Slots)			**$62.49**	**subtotal**
Cardstock and printing costs of Tabletop Escape components		$62.49		
Poster Printing Costs		n/a		
Cardstock and printing costs of cards for Stochastic slots (card decks, props)		$0.00		
Participant funds: Prizes for Math Bingo, Stochastic Slots, Tabletop Escape			**$275.79**	**subtotal**
MAA subscription: student x 2		$0.00		
Chocolate		$4.37		
Math Metal Puzzle		$14.61		
Rucksack Stochastic Slots Prize		$12.43		
Headphones Stochastic Slots Prize		$28.24		
Games: Trivia, bingo set, table tennis, escape room activity		$103.91		
Calucators, USB, geometry sets, pencils		$97.53		
Agenda		$14.70		
Speaker & Organizer support: commemorative gift packet			**$253.24**	**subtotal**
Leather-cover notebook x 5 (also used as prizes)		$28.24		
Volunteer (non-speaker) gift card		$25.00		
Indigo Gift Cards (StudC funding) x 4		$200.00		
Homemade memento x 4		$0.00		
	TOTAL EXPENSES:	$811.47		

After the event, carry-forward amounts used for:

$ 150	$\pi - \epsilon$ Day festivities: undergraduates at Carleton University heard a small presentation about the Lisa Simonyi and the IAS Women+ and Mathematics program ahead of the pi recitation contest
$ 108	Used for reprinting the math game cards that were used up or tattered during the Ada Lovelace Birthday Bash, so they can be of use at future math events

4.6 Itemized by Report

LovelaceBirthdayBashReimbursement01

Expense	$ 83.63 = $ 40.68 + $ 16.94 + $ 11.30 + $ 14.70
Report Date	September 1
Expense Type	Grocery and 3×Student Recruitment

Popcorn and A&W Drinks - Expense 1

Gifts to Presenters - Leather Notebooks 3,4,5

Gifts to Presenters - Leather Notebooks 3,4,5

Tabletop Escape Prize: Agenda

LovelaceBirthdayBashReimbursement02

Expense	$ 114.32
Report Date	December 15
Expense Type	Grocery

Soda pop, biscuits, wafers, and cookies for the Ada Lovelace Birthday Bash student event and mini-conference as well as craft supplies for constructing the two interactive Pop-Up dioramas for the Tabletop Escape Room game held at the event.

LovelaceBirthdayBashReimbursement03

Expense	$ 60.63= $ 32.43 + $ 28.20
Report Date	December 15
Expense Type	Student Recruitment
Expense Type	Grocery

Gift bags to house team prizes, speaker gifts, and food. Cups for soda pop served at the conference-to-event break. Puzzle for the Stochastic Slots game prize. Soda pop.

Conference Snacks served at the Ada Lovelace Birthday Bash student event and mini-conference. Nuts and pretzels.

LovelaceBirthdayBashReimbursement04

Expense	$ 225.00
Report Date	December 15

Book gift cards for student speakers and volunteers, as supported by funding from Canadian Mathematical Society StudC.
Original plan was for five speakers; after the cancellation of one speaker the original pool of $ 200.00 was split between four remaining speakers. The fifth gift card being $ 25 instead of $ 20, as was budgeted in application to StudC, is an oversight on my part. Original plan was to buy book, A History of Women in Mathematics, which features Lovelace. But the book is not out yet. So gift cards were the hassle-free alternative.

Gift card recipients were as follows.
Speakers and outreach event organizers:

Amanda Chafee	100893509	(student is on health leave, returning in September.)
Yuliya Nesterova	101223645	(School of Mathematics & Statistics)
Puxin Shi	101284355	(School of Computer Science)
Christiana Koebel	101270523	(School of Mathematics & Statistics)

Non-speaker outreach event organizer:

Joseph Gondek	101146511	(School of Mathematics & Statistics).

LovelaceBirthdayBashReimbursement05

Expense	$ 144.57
Report Date	December 15

Prizes for Math Bingo and Tabletop Escape Room at the Ada Lovelace Birthday Bash, as provided by Fields Institute Outreach program funding.

LovelaceBirthdayBashReimbursement06

Expense	$ 97.53
Report Date	December 15

Prizes for the Mathematician Trivia and Stochastic Slots games. Includes a notebook, pencils, a novelty (disco ball) pen, calculators, geometry sets, and usbs.

LovelaceBirthdayBashReimbursement07

Gas money to cover the trips to/from stores to buy food and supplies and to cover two round trips to and from Carleton to get all supplies, food, and materials from organizer's home to the event.

Expense	$ 67.79
Report Date	January 12

No out-of-town speakers made the trip in bad weather.

Recipient	Expense Type	Amount	Date Incurred
Amanda Chafee	Parking	$ 18.00	08/12/2023

Other incurred costs:

- prototype printing,
- printing for Tabletop Escape,
- single-use plates and cutlery,
- bananas and apples,
- tape,
- paper.

4.7 Carry-forward from the Event

Pop drinks remained after the event: two bottles were donated to MSGSS for use during Pi ($\pi - \epsilon$) Day and the rest were used by the organizer at a math outreach mid-December. All fruit, pretzels, and most nuts were eaten. Leftovers included nearly all chocolate chip cookies and a few wafers. Prizes were popular and there was little left at the end. Special praise and thank you-s were received about the calculators (the scientific calculator was the most sought-after prize), the agenda, the notebooks, and the headphones. Bingo set, MAA subscription, and table tennis set were likewise sought out by winners.
Leftover prizes were pencils, a see-through novelty calculator, a leather-cover notebook (originally intended for a fifth speaker). These were handed out at the next big math outreach event, Pi (minus epsilon) Day. One pack of pencils was handed out to an undergraduate introduction to business mathematics class as a prize for their end-of-semester review game, to further increase the promotional reach of introducing students to the IAS and its function.

Sequence: Win on the 10th Draw: Horizontal

- **Fix the first ball**
  - Without loss of generality: Take the first Bingo ball to be O61.
- The nine previous numbers can come from B, I, N, and G in a few shapes:
  1. 4311
  2. 4221
  3. 3321
  4. 3222
- These shapes are partitions of the number 9 into four parts with conditionals:
  - No number may appear more than four times.
  - No partition may be empty.

Data Analysis Process

- Data Collection
- Data Cleaning
- Model Training
- Model Evaluation
- Prediction

Ada Lovelace

The First Computer Programmer

Carleton University

December 8, 2023

Chance of winning is currently
Play Stochastic Slots!
Analytic Engine Mini
Teddy Bear Mini
TUNE

Start Here
2,023