

math

NEWS

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Renovations and makeovers galore!

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lookAHEAD

mathNEWS

July 25 Issue 6 makes everyone groan with awful puns

CECA

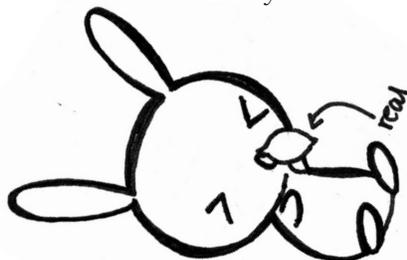
Ongoing Employer Continuous Interviews
 July 25 Match Results
 July 30 Match Results

University

July 28–Aug. 4 Pre-Enrolment Period (Winter 2015)
 July 30 Classes End
 Aug. 5 On-Campus Examinations begin
 Aug. 8–9 Online Class Examinations
 Aug. 16 On-Campus Examinations End
 Aug. 25 Co-op Term Begins
 Aug. 25 Fees for Fall 2014 Due
 Aug. 31–Sept. 6 Orientation Week
 Sept. 8 Lectures Begin (Fall 2014)
 Sept. 17 Grades Official on Quest

Miscellaneous

Aug. 4 Civic Holiday
 Aug. 5 Work Like a Dog Day
 Aug. 8 Sneak Some Zucchini onto Your Neighbour's Porch Day
 Aug. 18 Bad Poetry Day
 Sept. 1 Labour Day



**What's really long and green?
 The real lime!**

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Murphy Berzish (Super algorithmic), Katherine Tu (Peculiar and non-even), Rachel Wiens (Likes eating pi)

mastHEAD

Rabbits are preyed upon by many other animals, and as such have developed many mechanisms to ensure that we can run away as fast as possible, whenever possible. Among these mechanisms are our iconic ears—they are very sensitive to even the slightest sounds. Although loud, surprising sounds are very unpleasant for us rabbits, we are able to appreciate rock and roll.

Another, however lesser-known mechanism, is sleep. Rabbits do not sleep the same way that humans and a lot of other animals do. Since rabbits need to be conscious and alert at all times, we sleep with our eyes open. We can still hear and see when we are resting, so that we can dart away at a moment's notice. However, this does mean that rabbits require quite a lot of rest, and do so.....zZZz..... Sorry, I must have dozed off. We sleep quite often, as you can observe.

As a mathie rabbit, it is sometimes difficult to keep up with academics when you require so much rest! Especially when you sit down, get comfortable with your tasty books in front of you, and then just.....zZZz.....zzZZZZz.....

Oh, gross! How did drool get on my books? (Paper is best when crispy.)

In any case, as a mathie, it is very important to master the art of staying awake, which I cannot do. If staying awake was required during an exam, I would surely.....zZZblffh. I would surely not do so well! Because of my extreme deficit, I wondered: if there were exams for basic life skills..... Would my writers fail some as well? And which ones?

I asked them while I was awake.

arabesque ("handwriting"); IceNine ("Flossing"); MeaninglessQuips ("Wording"); Stubbs ("Fail? I would cram the night before and pass that shit! Unless it was Stats."); Zethar ("Probably my cooking. Last time I tried to make something as complicated as a salad, it caused the First Lunarian War and *mathNEWS* came to be."); BlueberryMuffin ("Romance"); waldo@<3.LE-GASP.ca ("Decision making"); (define this (not cool)) ("Cleaning. Or cooking. Or cleaning while cooking, though perhaps that's not 'basic'."); ScruffyED ("Staying put."); & ("The subject doesn't matter—I would fail to show up to write the final on time."); unit ("sweeping");

bunniED ("Zzz.....")

**What do Canadians use to solve
 some differential equations?
 The Lacrosse Transform!**

Office Gossip # 4

Novelties

As unusual as it may sound, one of my favorite parts of large lectures was walking in at the start. I would always make a habit of coming in from the front just after everyone has settled in. The wall of people, the sound of a hundred people talking... as a student from a small town, the experience was always surreal. You could always tell all the different groups and cliques by how they were sitting, how they were talking, and in some cases what they were wearing. I've always had an interest in people-watching, and walking into large lectures was like a super-strong dose of it.

Something that always intrigued me about people-watching was what people were wearing. Clothes are one of the easiest and most effective ways of passively expressing oneself, and these expressions are often most interesting. One of my favourite, and most blatant, examples of this are the amusing or licensed T-shirts. These shirts are a great way of sharing with others a joke, an idea, an interest, or a fandom. T-shirts for mainstream interests are available in many stores, but what if you want a shirt for someone more unusual? Something like math?

MathSoc understands that many of our students share this common interest and would love to be able to express it. That's why we have a large selection of novelties, including T-shirts with various math jokes and references. All of our T-shirts are only \$15! We also have tank tops, sweaters, and bags. There are a number of smaller novelties with the MathSoc logo, such as clipboards, travel mugs, and shot glasses. Orientation also sells pink ties from previous years through our office. There are many different styles of novelties, so feel free to come by our office (MC 3038) and browse the available sizes and styles.

Darcy Alemany
MathSoc Office Services Manager

CSC FLASH

Greetings little Daleks,

Stressed about impending finals? Hang out with the CSC instead! We have planned one more event for you this term:

CSC Goes Outside! Yes, it's true—we occasionally leave our beloved computers to enjoy the great outdoors. Come join us tonight at 8:00pm at the EV3 Fire Pit! Snacks and drinks will be provided.

If you have any questions, concerns, or other general feedback, please email us at exec@cscclub.uwaterloo.ca, or drop by our office (MC 3036). It's been my pleasure to have been your Dear Leader for this term.

Jinny Kim
President Extraordinaire

Don't be an Idiot!

Remember that Monday July 28th through August 4th is the course selection period. Know what that means? A whole boatload of idiots will forget to register for the courses they want. (Looking at you readers.) If you want to take courses in the Winter 2015 term, you should plan out what you need and then register.

If you don't, don't plan on getting into any of the courses you want. That's because under this all-knowing new system of ours (which has supposedly improved), everything you would want to take will either be full by January or scheduled in 15 minute overlapping segments.

This is also how they gauge interest in courses. If only 3 1/2 people say they want to take "Intro to the Easiest Bird Course", then it's not likely to get offered if it isn't a required course for anyone. On a similar note, if only 150 CS students say they want to take CS 241 there will be at most 2 sections of 100. Then when another 200 CS students try to enrol in January, we get a lot of unhappy CS students who now are behind with their courses. Yay!

So, you should pre-enrol because it'll make your life easier. But you should also pre-enrol to make advisors' lives easier. Imagine if we all told them exactly what we wanted to take. Imagine how they could then know how to tweak the schedule to maximize student happiness. Imagine how much better they'd feel if they didn't have to reply to hundreds of e-mails the first week having to deliver bad news. They would be so much happier, and have so much more time for teaching.

So, don't be an idiot, and register for your damn courses next week.

Stubbs

Last week's gridSOLUTIONS:

E	V	E	E	P		Y	L	S		D	T	E	I	Y
S	E	K	L	U	M	R	A	Y		I	E	L		S
S	G	V	Z		I	L	C	V	C		E	G	V	P
A		L	V	E	H		S	W	E	N		N	I	Y
L	S	I	E	E	P	E		L	S	V		U	N	G
	S	I	L	N	V	L	V		Y	E	B	O		
L	I	H		K	R	V	L		E	C	I		M	P
V	A	S	V		E	K	V	N	S		T	N	V	
E	W		L	E	S		X	V	O	C		V	L	E
	T	L	E	D		D	E	W	L	Y	W	L	N	
O	E	L		U	V	E		S	R	V	E	P	P	V
D	D	V		N	E	M	V		T	T	I	P		I
L		R	E	F		T	I	B	R	O		V	L	S
U		H	V	N		L	V	B	A	L	W	B	E	S
O	L	L	O	M		G	E	B		E	R	E	U	O

Six Caveats to Taking the Most Interesting Courses That You Can

DEAR !ABLE:

You're intellectual. Is it worth taking a tough elective that would be really interesting (specifically, philosophy)? Or should I take a somewhat interesting, but easier elective? I've kind of been dying to take a philosophy course, but I also want to pass. I need your wisdom.

—AMBITIOUS SECOND-YEAR IN SOFTWARE ENGINEERING

DEAR AMBITIOUS SECOND-YEAR:

Hopefully by now you've figured out that easy but uninteresting classes (like PD) suck, no matter how easy they are.

I think the standard advice applies here: take the most interesting courses that you can. Of course, there are caveats:

1. Don't give yourself too much work. Unlike students in other faculties, for you, dropping courses that are too hard is not an option.
2. A hard, interesting course will usually cause your grades in core courses to drop, but, provided that you don't fail any of them, you'll probably enjoy the term more. You should account for this based on your past terms' grades.
3. The 2A and 2B terms tend to be transition terms where students from good schools have to relearn how to study or else fail a term. Rumour is that most (but not all) students in my class who partied all day and got 90s in 1A/1B failed out in 1B/2A/2B.
4. Some professors choose to exercise professional judgement; others do not. Rumour has it that one student walked away from Astrophysics with 100 despite failing the final exam, because he did better than all his classmates.
5. You may overestimate how much time you'll spend on a course and underestimate other difficulties. JAPAN 102R was one of my lowest grades because I overestimated how much time I'd spend studying for it and underestimated how hard it would be to break into the cliques formed in JAPAN 101R.
6. Taking a hard elective with your smartest/bestest friends will make it easier.

You might want to talk to your academic advisor to see if they can give you more information to help you make a better decision. Good luck!

!able

A Long-Expected...

My dear friends. My dear writers and editors, artists, proofreaders and accountants, newshounds and satirists. Also my good editorlings that I welcome back to the office. Today is my third editor-birthday; I have been an editor for three years today! I hope you are enjoying the issue as much as I am.

I have called you all together for a purpose. Indeed, for three purposes. First of all, to tell you that I am immensely fond of you all, and that three years is too short a time to spend among such excellent and admirable Mathies. I don't know half of you half as well as I should like, and I...skip a bit here...yes.

Secondly, to celebrate my birthday. I should say, our birthday; for it is also the completion of the one-hundred and twenty fifth volume of this great publication. Together we score one hundred and twenty eight; $1 << 7$, if I may use that expression. Three years ago today, or thereabouts, I was given my editor name, although it did not seem so important then, and I could only say, "Thank you." I now repeat it more correctly: Thank you very much for leaving me in charge for all this time.

Thirdly and finally, I wish to make an announcement. I regret to announce that—although, as I said, three years is far too short a time to spend among you—this is the end. I am going now to seek a grand adventure, in the deep and dark places of the world, in the caves of formal verification and the mountains of real-time simulation, and one day I may finally find my way between the border of hardware and software. And though you may see me again from time to time, with every beginning there must come an end; tomorrow I will not be your editor.

The wind is at my back and the skies are clear. Farewell wherever you fare. I am going now. Good-bye!

ScruffyED

Potato Salad

Kickstarters are strange beasts. If you desire simply \$10 to make some potato salad, you can end up on national news as a human interest story. People give you money because they have been entertained by your idea, not that they think it is a good one. This could be seen as a subversion of crowdfunding, but it honestly just seems to me as the evolution of microstock corporations, save that few people would sell their "stocks" or "reward tiers" and that stocks are not linear in their value. It's a strange beast.

Anyway, potato salad is cool. Some guy made over \$60K on it. Check it out on Kickstarter, and let your dreams run wild.

Ice Nine

Clock Errata and Follow-Up

From v125i5's "Regarding a Certain Clock"

A physics graduate from UW (who was visiting me in Victoria!!) has informed me that I screwed up when I wrote "... marching forward at a constant rate ...". I was incorrect because of special relativity.

There are two ways to look at this. One is that in each person's own personal reference frame, time moves at the same constant speed. The other is that in the (rotating, which we'll conveniently ignore) reference frame of, say, the center of the Earth, any human with velocity relative to the core will have time run more slowly for them, and hence since most humans are not in constant velocity, time doesn't move at a constant speed. Really, any observer will do, much like any dream.

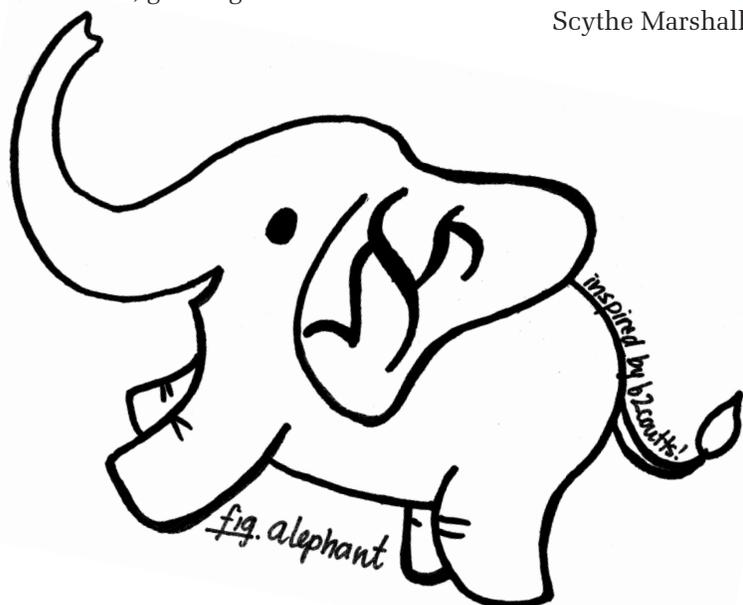
As much as I enjoy being scientifically correct when I write, this is one of those circumstances where it mostly doesn't matter. Perhaps I just intended for the reader to think about it! Aha! What a brilliant conclusion. (Cough cough, clearly she was right and I needed to mention that in the article. Whoops.)

On another note, a side-project of mine is to 'solve the clock', i.e. learn how all those expressions on the not-actually-aforementioned-unless-you-consider-last-fortnight's-issue actually evaluate to the correct thing. I have accomplished this feat! Hopefully I'll have solutions up sometime in the near future, and perhaps point to them in the office. Of course, I believe I'll put up some hints, in case anyone is stuck but still wants to do most of it themselves.

Finally, sleeping on couches which are too small is really uncomfortable, and this is doubly so if you fall asleep while writing a *mathNEWS* article and then don't actually get it written until the morning, when you wake up and promptly freak out about not having finished writing the article. Oh well! Might as well drop a hash-tag here: #absentewriterproblems

And now, goodnight.

Scythe Marshall



Bad Math

Bad Economics

Frequently, the free market and private industry are held up as examples of how to drive increases in efficiency. The idea is that private industry will increase efficiency in a goal to increase profit. In theory, this works fine. A company reduces cost of production, then sells goods for cheaper, increasing the amount that they sell and their profit. Even if the price of the good doesn't decrease, profit increases. In either case, the efficiency of the business is increased.

This idea is all well and good, except that it doesn't work in many real-life situations. Take, for example, provision of Internet access. It is desirable that even small towns have connections to the Internet, but building the infrastructure is really expensive. This same problem affects things like roadways, which have historically been built by governments. However, roadways are not usually a "pay-per-use" model, and are built entirely with public money. Put more abstractly, what should happen if it is uneconomical for a company to do X, it is desirable for X to occur, and the government doesn't want to do X?

Privatization also does not necessarily lead to efficiency gains when a natural monopoly exists on the good or service. In smaller areas, this can happen with provision of electricity. A private company with control over the production of electricity can out-compete any attempted entry to the market, and then abuse the position of power to exploit customers. In this case, the company is interested in increasing efficiency, but much less so than when there is competition. As long as the consumer is willing to pay for the service, the price can be increased, resulting in higher profits without any additional work. Frequently, governments run these industries, or regulate them to avoid exploitive behaviour.

A third case in which privatization does not help is in industries where maximizing profit can be actively opposed to the goals of the industry. The quintessential example of this is for-profit prisons. The goal of the correctional system is to make it so that prisoners become functional members of society. However, to maximize profit, the prisons want to maintain or increase prison population. This turns into a vicious cycle, which has been coined the "Prison-Industrial Complex". A potential solution is to link payment to performance, though how to measure performance is not obvious.

It would be nice if the free market would solve everything and maximize the good things while minimizing the bad things. But it can't. Ah well, the government has to have something to do!

MeaninglessQuips

What's yellow, normed, and complete?
A bananach space!

Putting a Stopper on Logic

The Apprentice's Introduction to Model Checking

Model checking is a powerful technique that performs a type of formal verification—that is, proving or disproving correctness properties of systems or algorithms. In particular, model checking takes a model of a system and a number of assertions about the specification that must be met, and then automatically checks whether the model satisfies all the assertions in the spec. This is usually done in practice by checking for counterexamples to assertions. For example, if one fact about my model is “Anything in set X has property P”, and the specification asserts “Nothing with property P should also have property Q”, then if I can find something in X that has property Q, I can show that the specification is not met.

Besides looking for counterexamples, we can also perform a task called “model finding”, which is like model checking but with no assertions and hence no search for counterexamples. Here, we seek to find any model at all that obeys all of our stated facts about the system. This can be interpreted as finding assignments of variables to satisfy a logical formula, which reduces to SAT — and indeed, a SAT-solver is what lurks behind the walls of most popular model checking packages.

Potions and Proofs

Today I would like to show you a small taste of model checking and model finding, in the context of conjuring from thin air the solution to a logic puzzle. We will take as an example a puzzle given in the novel *Harry Potter and the Philosopher's Stone*. The model we seek is hidden inside this poem:

*Danger lies before you, while safety lies behind,
Two of us will help you, whichever you would find,
One among us seven will let you move ahead,
Another will transport the drinker back instead,
Two among our number hold only nettle-wine,
Three of us are killers, waiting hidden in line
Choose, unless you wish to stay here forevermore
To help you in your choice, we give you these clues four:
First, however slyly the poison tries to hide
You will always find some on nettle wine's left side
Second, different are those who stand at either end
But if you would move onward, neither is your friend;
Third as you see clearly, all are different size
Neither dwarf nor giant hold death in their insides;
Fourth, the second left and the second on the right
Are twins once you taste them, though different at first sight.*

Our goal is to find an assignment of the labels “Ahead”, “Back”, “Wine”, and “Poison” to each of our seven bottles that is consistent with all the clues in the puzzle. If we can find such a model, we will have solved the puzzle and determined the location of every bottle. But we'll need a little help...

Copper and Zinc

The model-checking code in the remainder of this article will be based on the Alloy relational-modeling tool (alloy.mit.edu). The Alloy language allows the modeller to describe relations between sets and assertions about their properties, and provides tools to automatically find models satisfying a given set of constraints or contradicting one or more stated assertions. In this example, we will not use assertions, since our goal is to find a satisfying assignment for some given set of constraints.

If you are following along on your own, please get a copy of Alloy—it is a Java program, so it will run anywhere the JVM is supported.

We start our incantations by describing the universe of things we wish to consider as part of our model. In our case, we wish to speak of bottles, so we must tell Alloy just what a bottle is:

```
abstract sig Bottle { left: lone Bottle, right: lone Bottle }
```

In Alloy, a sig, or “signature”, is a set that contains “atoms”. Each atom is an instance of a particular object — in this case, a single, indivisible bottle. So our signature “Bottle” is the set of all bottles. We say that this signature is abstract because we are going to subdivide the set of bottles a bit further, in just a moment. The remainder of the signature tells us what kind of properties a bottle can have. Since our bottles are in a line from left to right, we say that each bottle can have a “lone” bottle — which is to say, either one bottle or none at all — on its left, and a lone bottle on its right. We need a bit more than this to describe the formation of our bottles formally, but all in due time.

To label each bottle with its contents, we can describe the possible subsets of our set of bottles like so:

```
sig Ahead in Bottle {}  
sig Back in Bottle {}  
sig Wine in Bottle {}  
sig Poison in Bottle {}
```

We also introduce a fact to ensure that these subsets are everything a bottle can be:

```
fact {Ahead + Back + Wine + Poison = Bottle }.
```

Here we take the + operator to be set union — so what this states is that every bottle that exists is in (at least) one of these subsets.

From the puzzle, we know that there are three bottles of poison, two bottles of wine, one potion to transport the drinker ahead, and one to transport back. We can express these facts as cardinality constraints, which make statements about the number of elements that can be in each of these sets:

```
fact {#(Poison) = 3 #(Wine) = 2 #(Ahead) = 1  
      #(Back) = 1 }
```

And in order to be clear later on when making statements about individual bottles, we can ask for particular bottles to be instantiated and given names, like this:

```
one sig One, Two, Three, Four, Five, Six, Seven
extends Bottle {}
```

Now it is time to start lining up our bottles. We put bottle one on the far left and bottle seven on the far right, so there is nothing beside them:

```
fact { no One.left no Seven.right }
```

As for the rest of the bottles, we can specify their order from left to right:

```
fact {
  Two in One.right
  Three in Two.right
  Four in Three.right
  Five in Four.right
  Six in Five.right
  Seven in Six.right
}
```

At this point we do not yet know what is to the left of any bottle except the first. Rather than spelling it out explicitly, we can use a bit of logic to tell the system how to figure out what goes where. We know that for all bottles A and B, if B is left of A then A must be right of B, and vice versa. Here is how we state this formally:

```
fact {
  all a: Bottle | all b: Bottle | b in a.left
  implies a in b.right
  all a: Bottle | all b: Bottle | b in a.right
  implies a in b.left }
```

We need two more conditions to state a certain physical consequence of nature—see if you can divine the meaning of this yourself, as an exercise:

```
fact { all b: Bottle | b not in b.left
  all b: Bottle | b not in b.right }
```

And with that, our description of the line of bottles is complete. Now we can start using the rest of the puzzle to tell Alloy how to go about finding which bottles contain which liquid.

Picking our Poisons

Let's look back at our puzzle, or should I say, "specifications document", and go through our clues one at a time.

Clue 1:

*...however slyly the poison tries to hide
You will always find some on nettle wine's left side.*

This clue gives us two facts about our model:

```
fact { all a: Bottle | all b: Bottle | a in
  Wine and b in a.left implies b in Poison
  One not in Wine }
```

(Bottle One cannot be wine, because if it were, we would need poison on its left, but there is nothing on its left. So this special case we need to spell out explicitly.)

Clue 2:

*...different are those who stand at either end
But if you would move onward, neither is your friend.*

This gives us a few facts about bottles one and seven. We know that neither of them will move us ahead, and we also know that the set {One, Seven} cannot be a subset of Back, Poison, or Wine, since that would otherwise mean they were not different.

```
fact { (One + Seven) not in Back (One + Seven)
  not in Poison (One + Seven) not in Wine One not
  in Ahead Seven not in Ahead }
```

Clue 3:

Neither dwarf nor giant hold death in their insides.

For this clue to make any sort of sense, we need to go back to the customer and ask for them to clarify the requirements — there is some extra information outside the puzzle that we are missing. Fortunately, finding the sizes of the bottles at each position is not a tricky thing to uncover. We learn that bottle three is the smallest and bottle six is the largest:

```
fact { Three not in Poison Six not in Poison }
```

Clue 4:

*...the second on the left and second on the right
Are twins once you taste them, though different at first sight.*

We only get one fact out of this, but it is a bit complex:

```
fact { (Two + Six) in Ahead or (Two + Six) in
  Back or (Two + Six) in Poison or (Two + Six)
  in Wine }
```

Speak the Magic Word

Lastly, we need to tell Alloy how to start looking for satisfying models. Normally, if we are searching for contradictions, we would need to determine some maximum "model size", that is, how many objects to consider among all sets. We still need to do that here, but in this case we know that since there are only seven bottles, it does not make sense to check models of any larger size. So, as the last line of our model file, we ask for Alloy to run the solver like so:

```
run {} for 7
```

If you have been following along in Alloy yourself, please click the "Execute" button at the top of the main window; you should see the status pane on the right display "Instance found. Predicate is consistent." once you have done so. This response indicates that Alloy has successfully found a model that corresponds to the assertions we have made. To see the solution, click the "Show" button, and the contents of all seven bottles will be known to you...

I fear my time for today is up, but I hope you have had a chance to experience the magic of model finding, and I encourage you to pursue your studies of logic, computer-assisted proofs, and formal verification if this has interested you. It may be useful to you someday—knowledge is power, after all.

Competition for the Worst Place on Earth

DISCLAIMER: *This is not a funny article.*

Hopefully most of you have not been watching the news because it is completely unbelievably horrific. Seriously, parts of the world are constantly trying to kill other and right now we're experiencing an abnormal amount of killing.

Egypt: Since its revolution it's still not the safest or nicest place to visit. Just on the 19th, twenty Egyptian troops were killed at a checkpoint when men armed with machine guns and grenade launchers attacked. This is why governments should endeavour to prohibit the possession of grenade launchers (looking at you U.S.A.).

Ukraine: Not middle-east. Thank goodness that the Malaysian plane that the pro-Russian rebels shot actually has a physical crash site else we'd have been subjected to a few months of CNN going "Where is the plane?" So, the pro-Russian rebels in Ukraine shot down a plane with equipment given to them by the Russian government. Putin, of course, flatly denies that he gave them the equipment, which of course means that he must not have done it. Why would Putin lie about anything? Also, Putin said that the tragedy would never have happened if there was peace in Ukraine... Which is true, but he seems to have missed the point. If you don't give people guns, they have a harder time shooting each other.

Syria: Syria is experiencing a full-on civil war made worse/better because no external forces want to intervene in a decisive way one way or the other. Basically, different foreign powers are backing different rebel groups with the hope that theirs will come out on top. But they can't do it in an obvious way because that would look bad. Also, the U.S. seems to be really trying not to get involved in any way whatsoever, which is probably the right choice. This is because there are large parts of the Syrian

population that don't want them to. They are also jaded from Iraq and arming rebel units has back-fired for them in the past (see Afghanistan).

Iraq: Spill over from Syria. ISIS (The Islamic State of Iraq and Syria) has been scarily good at carving out a huge swath of land in both Syria and Iraq, so much so that gas prices spiked world over from fear that they caused. These guys are so extreme that even Al-Qaeda has distanced themselves.

Gaza: Israel just rolled tanks back into the Gaza strip with the intent of destroying rockets, mortar pits, and arms in general. The problem is that Hamas, the Palestinian government, tends to keep these things as close to civilization installations as possible. Why? So that when the Israeli army hits their targets they also hit schools or hospitals inflicting civilian casualties. Why? Initially, it was because the Israelis wouldn't attack those targets because they might hit civilians. Now, it's so they can turn around to the international community and scream bloody murder. Both sides are in the wrong. Who is more wrong? They're both more wrong. It's easier to not pick a side and just call them both murderous fucktards.

On a side note, before we announce the winner, good news: there are only at most two genocides in progress right now, one in the Congo and one in Sudan/South Sudan. So go team!

And the winner is: Detroit! Detroit was shutting off people's water who couldn't afford to pay to keep the taps working. Basically, people who don't have anything were being denied water because money. This is just the latest thing in Detroit's existence that makes it the worst place on Earth to live!

(Except not really, I'd take Detroit over Iraq or Syria right now.)

Stubbs

Every Day is Pi Approximation Day

July 22nd is known for being Pi Approximation Day. It is a day where mathematicians celebrate the circle constant by eating approximately pie. Though, when you think about it, any number can be considered in the neighbourhood of pi, provided that one has a sufficiently large error bound. So on January 31st when you decide to eat macaroni and cheese, are you not celebrating pi by eating food that is as close to pie as 31/1 is close to pi? Though I will acknowledge that some approximations are better than others and we should by no means stop our current celebration for the days we already acknowledge as pi days.

Beyond Meta

N Reasons I Haven't Written a *mathNEWS* Article in Ages

Waldo has been finding it very difficult to write for mathNEWS lately.

- Academia and the glorious-ness of assignments and mid-terms
- The Altador Cup on Neopets for the entire month of June
- Procrastination
- Rehearsals for a big show coming up
- Family
- Getting lost in the Internet
- Not being in Waterloo for a good chunk of time
- Dealing with absolute nonsense

waldo@<3.LE-GASPCa

**What's purple and commutes?
An Abelian grape!**

**What's lavender and commutes?
An Abelian semi-grape!**

Bread and Butter

This recipe is very forgiving—if you're inexact with the measurements, you'll still end up with bread.

Ingredients

- 1-2 tsp yeast
- 1-2 cups warm water
- ~1 tbsp (3 tsp) sugar
- ~2 tsp salt
- 3-4 cups flour
- butter

1. Combine the yeast, water, salt, and sugar in a large bowl. Mix well.
2. Add the flour and mix until everything is incorporated.
3. Let some frustration out by kneading the dough (~10 minutes).
4. Form the dough into a ball, then place the ball back in the bowl.
5. Cover the bowl with a clean dish towel or with Saran Wrap.
6. Let the bowl sit in a warm place for about an hour, or until the dough is about double in volume.
7. Preheat the oven to 350 degrees Fahrenheit (175 degrees Celsius).
8. Melt some butter.
9. Grease a loaf pan or cookie sheet with the melted butter.
10. Take the dough out of the bowl and knead it.
11. Form the dough into a loaf or ball, and put it in the buttered pan.
12. Brush the top of the dough with the rest of the melted butter.
13. Put the dough in the oven and bake for 30-45 minutes, or until the top is nice and golden.
14. Take the bread out of the pan, and let it cool.
15. Eat.

\&

N Signs it's the End of the Term

Where in blazes did the time go?

- Everything ever is due all at once (or at least it seems like it)
- End of term events are happening...all at once
- Final exams are like, tomorrow
- An actual vacation is the day after tomorrow
- The FOC are going nuts across all faculties trying to get things all ready for O-Week (wait...that's actually a year-round thing)
- People are posting their schedules for the next school term!
- Soon it will actually be time to SLEEP!

waldo@<3.LE-GASP.ca

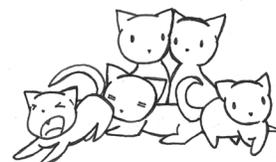


fig. Catalan numbers.

Quick Tip for Making Arm Training Efficient using Various Angles

Guys want big arms. Do you also want to look good in tank tops for the rest of the summer? Here are a few tips for lifters grinding weights in the gym. "Angles" refer to the arm position relative to the torso as well as the grip. If you perform curls or triceps extensions using only one grip and angle, your arm muscles and all of the heads (of triceps and biceps) are not being targeted effectively. This can also result in underdevelopment of certain heads of the arm muscles.

You can target the biceps' short head by performing exercises with your arm in front of the torso (like preacher curl) and target the biceps' long head when your arm is behind the torso (like incline bench dumbbell curls). You can also target your biceps and recruit your arm flexors differently by using various grip variations on biceps exercises, such as the neutral grip (like hammer curls), or taking a closer (working the outer biceps) or wider grip (working the inner biceps) on the barbell during standing curls.

For triceps, the long head can be targeted better using exercises that position your arms overhead (such as dumbbell extension) while going from an overhand to an underhand grip (as when doing press-downs) shifts the emphasis from the lateral to medial head.

In sum, using a variety of grips and arm positions can target the various heads of your biceps and triceps for more complete development.

SUPER BUFF

Looking for Morally Bankrupt Workers

Have you ever wanted to work for a company that spreads evil in the world? Ever desired to bring despair upon people? Well then, come work for the lottery, the company that sells hopes and dreams though never delivers.

Relish in the bureaucratic inefficiencies that come with being employed for the government. Rejoice as the mongrels that always looked down on you for liking math waste their money week after week. Work for the OLG and every day you will profit from dreams of the desperate and needy.

Beyond Meta

profQUOTES

“A one-dimensional affine space is called a line. A two-dimensional one is called a plane. A three-dimensional affine space is called a three-dimensional affine space.”

New, MATH 247

“You can say ‘Hermitian’ to sound sophisticated. If you say ‘self-adjoint’, people will immediately know what you mean. So it’s always better to say ‘Hermitian’.”

New, MATH 245

“‘Portal’? I’ve played it. It’s a good game.”

New, MATH 245

Prof: “So, step 1...”

Students: “Step 2.”

Prof: “Oh yeah, two comes after one.”

New, MATH 247

“This isn’t a definition. It’s a vaguely-worded remark.”

New, MATH 245

“...because what I told you last lecture was a lie.”

Nomair, CS 246

“Some videos on YouTube are very popular. One million hits, not a problem; but the average number of subscribers of a channel is, let’s say about 10, including mom and dad. ”

Lanctot, CS 234

“ ‘Smush’. That’s a mathematical term.”

VanderBurgh, CO 380

“How many of you have friends in engineering? I know many of you won’t admit to it.”

VanderBurgh, CO 380

“Remember when you were in high school and you learned how to complete the square? This is not that.”

VanderBurgh, CO 380

“We would probably get 85 different answers, even though there are only 80 people in this room.”

VanderBurgh, CO 380

Student: “Is there a way to recover some of that energy lost in the resistor?”

Prof: “Yes, well you could boil a cup of coffee or fry an egg with it.”

Wilson, NE 344

“I really hate erasing the board. If they come up with a board like an Etch-A-Sketch... Hmm... No, it would be really hard to shake the board.”

Abukhdeir, NE 318

“Writing on the board is very tiring.”

Abukhdeir, NE 318

[*Talking about efficiency of binary search tree.*] “Fashion industry: tall and skinny; Computer Science: short and fat [is better for quicker search].”

Lanctot, CS 234

“The answer is I don’t know how to do what you’re asking.”

Richter, MATH 239

“I don’t know how to write this in a nice way, so I’m not even gonna try.”

Richter, MATH 239

“Different people have a different understanding of what ‘trivial’ means.”

Richter, MATH 239

“I intentionally tried to trick you, so thank you for falling into my trap.”

Richter, MATH 239

“I’m sure many of you are confused right now. That’s all right, you’ll sort it out.”

Richter, MATH 239

“It’s so not fun. I’m tempted to put it on the midterm.”

Lushman, CS 241

“This part of the course is filled with lies and half-truths.”

Lushman, CS 241

“You don’t like undefined behaviour when you are a programmer. You love it when you are writing a compiler.”

Lushman, CS 241

“There is basically no chance that your compiler will output code *that* short.”

Lushman, CS 241

“And you thought compilers were hard.”

Lushman, CS 241

“I know you’re thinking this is not gonna work, and I know it’s not gonna work, but I’m not done yet.”

Lushman, CS 241

“I can’t let you pass this course if you don’t know hexadecimal.”

Ivkovic, CS 251

“Don’t take Compilers and Real-time at the same time . . . or you can take them both and say goodbye to your friends and family.”

Ivkovic, CS 251

“In computer science classes they always teach you that coding is an art. Screw that!! You don’t want an artsy pacemaker!”

Fischmeister, ECE455

profQUOTES

“Normally I hate it when people use capital letters, but I’ve gone and put capital letters all over these slides...I must have been drunk.”

Tripunitara, ECE 358

“Remember, if you get captured by the enemy: name, rank, definition of uniform continuity.”

Marcoux, PMATH 450

“You can’t have vectors of size 1 billion converging to something of size 1! Bad, bad convolution operator!”

Marcoux, PMATH 450

“So we’re actually integrating this. Are we having fun yet?”

Marcoux, PMATH 450

“Finally we’re in a position to say something. Well... something intelligent. But just because we’re in a position to do so, doesn’t mean we will. Just building suspense here.”

Marcoux, PMATH 450

“The minute you hear nowhere dense there should be a Pavlovian effect. Now I don’t expect you to drool or your legs to kick up, but you should be thinking Baire Category Theorem.”

Marcoux, PMATH 450

[Writes “Theorem: The Ugly Truth” on the board.] “I think you’re old enough to see this”

Marcoux, PMATH 450

“Remember how much fun it was to compute the Dirichlet Kernel? Well this one is twice the fun with half the monkeys.”

Marcoux, PMATH 450

“Remember how we worked hard to get this [result]? Well actually, you mostly sat there while I worked like a dog at the board. But it’s okay, I’m not bitter.”

Marcoux, PMATH 450

“So we get $\pi/2 = \pi/2$ which is a well-known equality!”

Marcoux, PMATH 450

“We can keep doing this until we’re blue in the face. By induction, we can get as blue as we want.”

Marcoux, PMATH 450

“We are now in a position to defy the Gods! Well... at least the Gods of Fourier analysis.”

Marcoux, PMATH 450

Handwritten mathematical notation: $\langle |$ and $| \rangle$ are labeled "bra" and "ket" respectively. $\langle : 3 | \rangle$ is labeled "bra-kitty".

UWaterloo Student Solves World’s Problems

A Waterloo student is being heralded as the bringer of a new age for making possible the conclusion on many world conflicts. The student in question was trying to find a way to unblock his toilet while intoxicated when he accidentally set the faeces on fire, culminating in a large explosion. When he awoke from the incident he discovered that due to extreme pressure applied with a plunger, the fire had fully burnt all the excrement and produced another material that rapidly increases the rate of decomposition of nuclear waste.

The exact details of the material are being kept secret, but what isn’t being kept secret is the grand plan. With this material in hand, radioactive oil can now be safely used, and as such the entire global community (minus some states in the middle-east) has agreed that the middle-east can be nuked in its entirety. This is expected to bring a swift end to the ceaseless wars in the area. It is also expected to bring oil prices crashing down, as there will no longer be a need for revenues to support local populations.

The student has been given a \$10 Tim Card for his immense contribution. When asked for a comment, he said, “Tim Cards aren’t accepted on campus yet.”

Stubbs

Mike Duffy Charged Senate to Attend Personal Funerals, RCMP Say

RCMP charge sheet lists 31 offences spanning more than 4 years

The RCMP served Mike Duffy’s lawyer with the official charge sheet early Monday, outlining the 31 criminal code violations the suspended former Conservative former senator is accused of committing.

The charges state some of the travel expenses reimbursed by the Senate were for “personal and partisan activity.” There are also five expense claims for “personal attendance at his personal funerals and related ceremonies.” The supposed reason for his multiple funerals was repeated heart attacks and legal deaths which he miraculously survived, until, as in Futurama, it was discovered that instead of a heartbeat they were detecting, that it was simply gas moving in and out of Bender.

Duffy’s lawyer denies any wrongdoing by the corpse. By precedent set by the Cadaver Synod and Oliver Cromwell’s trial, a posthumous trial is scheduled for Sept. 16. If convicted, Duffy could face up to 14 years in cryonic storage until he can be resuscitated and tried on the more serious charges.

Ice Nine

Unexpected Results in Recent Zombie Outbreak

It's that time of the year again, where Zombie Virus Strain β is most prevalent on the University of Waterloo campus. This year, experts believe that as many as 150 students may be at risk of the virulent strain, which causes its victims to want to run around and chase other people to pass on the infection. The outbreak is expected to run its course over the weekend, and by Monday there should be no reason to worry.

However, in the midst of this outbreak, there turned out to be another group who proved far more deadly, and far more worrying than the minor nuisance which the strain usually brings when persons at risk fight off the macroscopic disease vectors with foam weaponry and various contraptions made of foot garments. This group consists of the students of the Trains lab (henceforth Trains students).

The average Trains student runs on caffeine and the impending existential dread which deadlines bring to a student when faced with a gargantuan task. Every day they work in the lab for inordinate periods of time, up to thirty hours a day and nine days a week. As humans, they have every advantage of being a human, such as not being (un)deathly allergic to a byproduct of polyurethane and diisocyanate nor able to be repelled by a woolen lower appendage covering. However, being eternally sleep deprived and easily irritable, they have the ferocity of those who unfortunately succumbed to Zombie Virus Strain β .

One reports of a harrowing tale when a zombie breached the protective barrier at MC 3018 and disrupted the delicate balance which keeps the sanity of the Trains students in check. What was released was a tumult of pent-up fury which could be best introduced by a roar of a dragon; never before on campus has such a rampage full of bloodshed been seen. Reports show that the trail of desecrated lifeless forms fan out from the epicenter of MC's third floor and reach even in DC. For several hours the area was a deadly hazard to people, and it wasn't until pizza was used to placate them that the fury died down.

Death toll was in the hundreds, reports quote, and certainly more deadly than the Zombie Virus Strain β outbreak this July.

Zethar

The Song of a Human Before Their First Mission

Can you hear the humans sing?
Truly our song can't be denied
It is the music of a people
Who will not be zombified!

We have a beating in our hearts
And we are breathing with our lungs
There is a fight about to start
'gainst the zombie scum!

In your classrooms are you bored?
Will you grab nerf and stand with me?
Beyond the zombie horde
Are there supply codes that you need?

Then join the battle that's led by our General Yoshi!

11fiftysix

The Same Person, Five Hours Later

Can you hear the zombies sing?
It is the song of the undead.
It is the music of a species
That won't rest until it's fed!

We have a hunger in our hearts
There comes a moaning from our lungs
Come now, all zombies, play your parts
Eat the human scum!

On our heads we wear a tie
It frightens humans to the core
If we kill them, then they die
When they stun us we rise once more

You're destined to join us and fight in the ranks of the horde!

11fiftysix



Fable Type 709A

Once upon a time there was a magical kingdom, and its ruler was a princess named Odile. Princess Odile was a real piece of work. She was in love with a prince from a neighbouring kingdom, Prince Seigfried.

Unfortunately for her, Prince Seigfried had already found his princess: the innocent and beautiful Princess Odette. Princess Odile was determined to win the prince’s heart, so she took up witchcraft. On a stormy, moonless night, she concocted a potion that was sure to make the prince fall in love with her, and with a mischievous smile she bottled the amber potion and invited him to dine.

The thunder and lightning crackled that night as the storm raged on, and all the swans of the kingdom flapped their wings in agitation. “Princess Odette,” they called, as they marched on a pilgrimage to her palace. “Wake up, gentle Princess Odette!”

A bolt of lightning crackled, whiplike, and flashed some unholy fire before Princess Odette’s eyes. She awoke with a start and knew immediately that her beloved Prince Seigfried was in danger.

The lightning crackled behind Princess Odile as she stood in the shadow of her own magnificent castle. “Have a drink,” her lips curled without a hint of warmth, as her hand offering a glass in golden amber. Prince Seigfried took the glass in his hands. Against the ominous warning of thunder he downed the drink.

The swans wove their wings and Princess Odette, whose heart was as light as a feather, sat down on the edge of the carpet of

swans. By some unphysical power, the swans began flapping their wings and lifted Princess Odette high above the sky. Away they flew, towards the monumental castle beyond their kingdom far off on the horizon.

By this time Prince Seigfried, was completely under Princess Odile’s spell. She waltzed with him as the amber light shone in his eyes. All he could see was the amber warmth and comfort — why shouldn’t he be here?

Far off into the distance, Princess Odette called out on her carpet of swans. “Prince Seigfried! Wake up, Prince Seigfried!”

And wouldn’t you know it, by some similarly unphysical phenomenon, at some immeasurable distance away, Prince Seigfried awoke from his spell. The amber light now seemed less comforting as he remembered the radiant Princess Odette, whose warmth was like the sun. He steadied his gaze and broke free from Princess Odile, and ran outside into the storm.

“Odette!” He called, and a cloud of white feathers embraced him. He looked up, and there was Princess Odette. The storm had ended, the clouds parted, and a full moon cast its calm gaze on the prince and princess. The swans flapped their wings again and Prince Seigfried and Princess Odette rode off into their kingdom in the distance.

And Princess Odile? She became the antagonist in a lot of other fairy tales and lived out the rest of her days selling poisoned apples to younger princesses. The end.

arabesque

Transit in Toronto

This co-op term I had the delight of commuting in Toronto, a city famous for two things: its mayor and its terrible traffic. A reputation that as I discovered is well deserved.

The best part of the TTC (Toronto Transit Commission) is by far the subway. The trains come fairly regularly and it’s usually not too crowded. The problem with it is that it only covers a small portion of the city. So if you ever have to travel somewhere not covered by the subway you will probably have to use the bus.

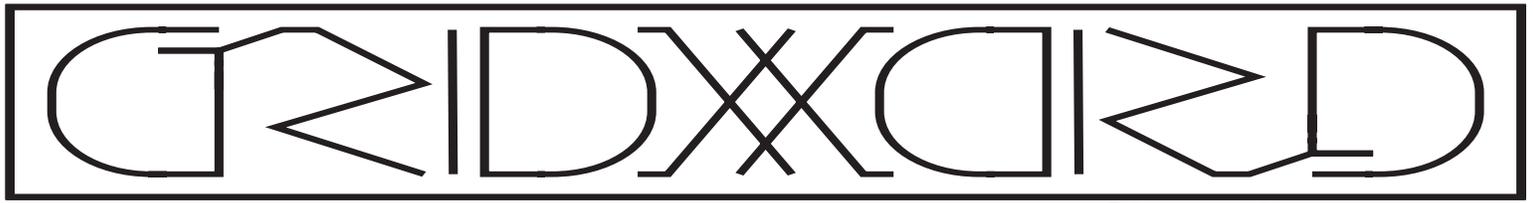
Buses seem to come far less frequently. There is really no point in taking one during rush hour. You have zero personal space and there’s so much traffic that it would be faster if you walked. I once got off the bus and beat three other buses on the same route simply by walking.

Even walking isn’t great, though. The cars in Toronto are impatient and constantly cutting off pedestrians. It is one thing to have little personal space on a bus but I really hate it when 2-ton machines of death invade my personal space. That’s just rude.

Beyond Meta

This week's gridSOLUTIONS:

D	L	S		S	Y	S		N	R	E		E	E	N
D	E	L	L	O	L	S		I	E	D		Y	C	I
E	V	I	S	O	R	E		G	N	I	L	R	V	A
			E	C	A	C	E	L		N	V	L		
X	E	L	I		E	U	S	S	I		E	S	R	A
E	V	K	S		D	I	M		V	Y	E	F	E	S
T	E	C	E	D		E	L	S	I			R	C	T
	T	N	I	M	R	E	G	V	E	R	E	V	O	
B	O	L		U	H	T		N	V	C	U	O	T	
L	V	A	F		C	H		M	V	A	R	E	C	R
B	B	A		N	V	E	C	O		R	O	D	O	O
			E	D	O		Z	L	I	L	B			
E	S	I	R	N	U	S		O	L	V	M	I	N	V
T	V	K		E	L	V		L	V	R	E	M	U	N
V	H	S		M	G	M		B	R	O		E	P	V



gridCOMMENTS

Seen at the staithes

Welcome to the last grid of the term. The answers are in verso folio. You are only cheating yourself if you peek. Good luck. Sorry about last issue's 30A: it was supposed to be the astrological symbol for Leo.

8 out of 10 submissions were perfect. Sorry, Pranav and Jasmine! Last issue's **gridQUESTION** was "Who let the dogs out?" because the song was stuck in my head. Paper Plane Kevin (whose plane didn't fly) didn't know, but warned us for our safety ("they're trained to recognize and attack *mathNEWS* writers!"); Pranav and Other Kevin answered "who". Daniel asked "Who kept the dogs in?" and Travis quipped about my security clearance. Jinny feigned ignorance ("What dogs?"), obviously implicating herself. I'm not sure what Abraham was trying to say. Other answers were "a mysterious void" (Jasmine) and "the Illuminati" (Rob).

I like Paper Plane Kevin's the most, so congratulations, Paper Plane Kevin! You may pick up your prize at MathSoc.

I hope y'all ace your exams! I have none this term. See you in September!

Cheers,
unit

1	2	3		4	5	6		7	8	9		10	11	12
13			14					15				16		
17								18				19		
			20					21		22				
23	24	25			26			27			28	29	30	31
32				33		34				35				
36					37		38		39			40		
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48			49			50		51		52				
53					54				55		56			
			57	58			59				60			
61	62	63				64		65				66	67	68
69				70				71						
72				73				74				75		

gridCLUES

Across:

1. Mirror
4. Globe
7. Film lion
10. Hash function family
13. e.g. Roman
15. Barleywine
16. Half a break
17. *Vivace*
18. Aurora
20. 9/7/40–5/21/41
22. $F(x, y, y', y'', \dots) = 0$
23. Olfactory stimulus
26. Poseidon's province
28. Agnetha, Benny, Björn and Anni-Frid
32. 10%
34. Sot's cry?
35. Wheat beater
36. Some Sam
38. *bu*
40. Chuck
41. Numismatist's nightmare
44. White, green, red
45. 26A's eye
46. Double-dealing duplicity
48. Peace
50. Neither high nor low
52. Boot blade
53. British ass
54. Offspring
56. Holly
57. Local area network
59. Derivative of the determinant
61. Little dear
65. Mordant and caustic
69. Gelid
70. *Agnus* ___
71. Like an absinthe spoon
72. Maiden name indicator
73. Seeaagull?
74. Above DIA
75. A namespace

Down:

1. Not kata
2. Calembour
3. Music company
4. Said
5. *a:b*
6. Marring mark
7. Pas' pairs
8. Strong carrier
9. *Reparo*
10. Slippery strip
11. Owns
12. Eated?
14. Hug an issue
19. Bona fide
21. Spirit of the age
23. DEC – 2
24. Pillow-wetter
25. Works of art
27. Itch
29. Bathy?
30. Frenchman's mica
31. Liturgical vestment
33. After *Ave*
35. Oft noxious
37. Hyundai Comboy
39. Tip to tail, ___ to end
42. Merciful pity
43. Just the worst
44. Our NASA
47. Typesetting system
49. Use not your inside voice
51. Coercion
54. Arising from conjugation
55. Worm-getting
58. Helping Hand?
60. What a dove does
61. Farore's friend
62. Untouched service
63. Better bread
64. Jenever
66. Common contraction
67. Dog doc
68. Ed, ___ n Eddy

What is clear, bubbly, and used by trendy engineers to solve some differential equations?

Perrier Transform!