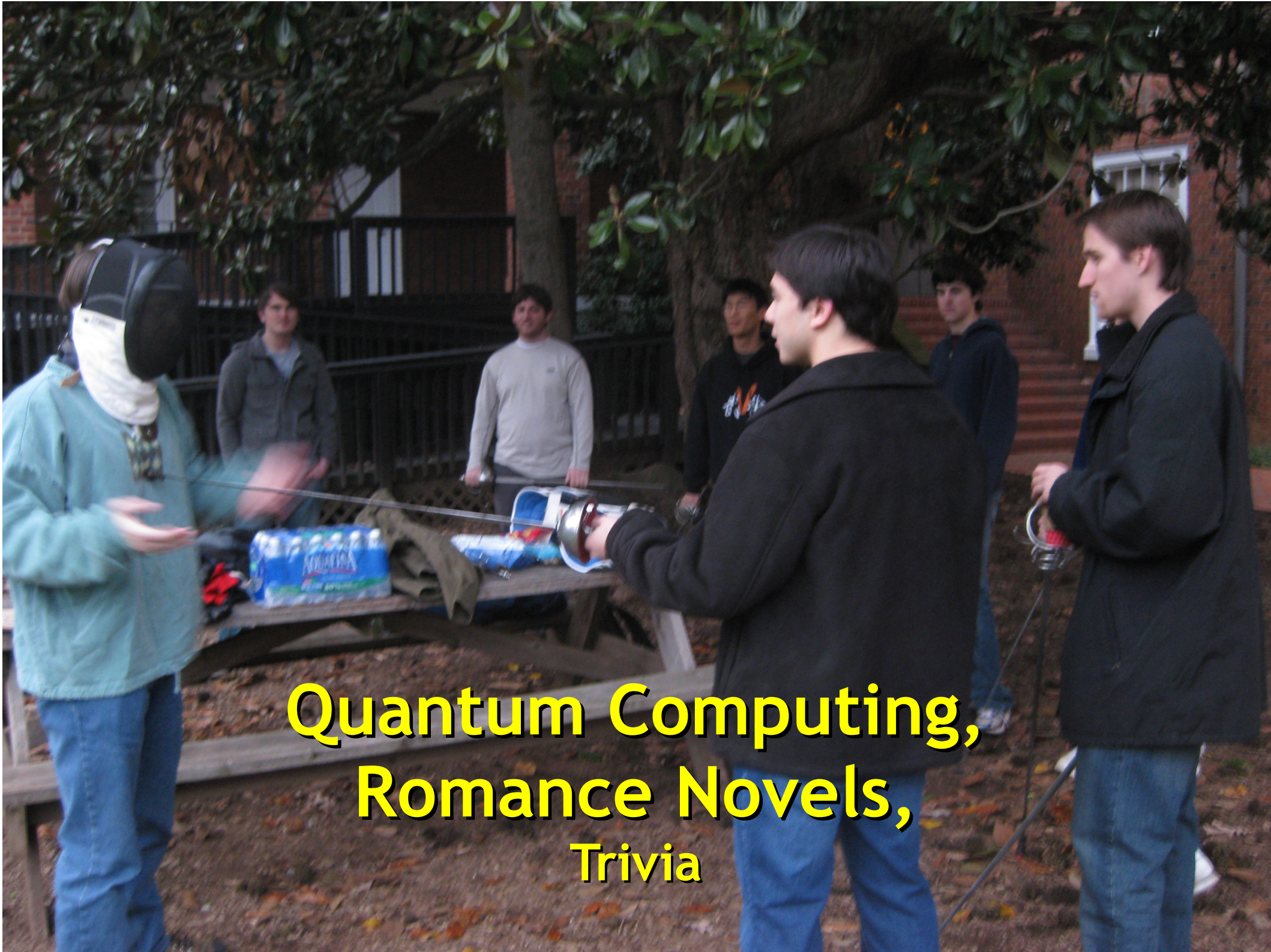

Quantum Computing,
Romance Novels,
Trivia

Course Evaluations

- This is the first time we have offered the 3+2 credit option for PL + Compilers.
- In the past, all students had to take the 3 credit part only.
- Should we have similar options in the future?
- Do you appreciate having difficult classes, assuming we warn you in advance?

Upcoming Due Dates

- Wed Dec 09 Midnight– all except PA6+Final
  - If I have the wrong grade marked down for you (see projected grades) or you want to turn something in late, Wed Dec 09 (tomorrow)
- Sat Dec 12 Midnight - PA6 (Optimizer) due
  - Extra credit.
- Mon Dec 14 Noon – Final Exam Due
  - Choose 7 of 8 essay questions, fit in space provided
  - Email wrw6y.doc (etc.) back to me ...

One-Slide Summary

- A **quantum computer** manipulates **quantum bits**; such qubits can represent a **superposition** of possible states.
- Quantum computers are **probabilistic**. **Grover's Algorithm** (for linear search in sub-linear time) and **Shor's Algorithm** (for factoring integers in polylog time) are common quantum algorithms.
- When you use a quantum computer to “try everything in parallel” you get back a **random answer**.

The Key

- The key to quantum algorithms is to make a bunch of parallel worlds that all have something (part of the right answer) **in common**.

Shor's Algorithm

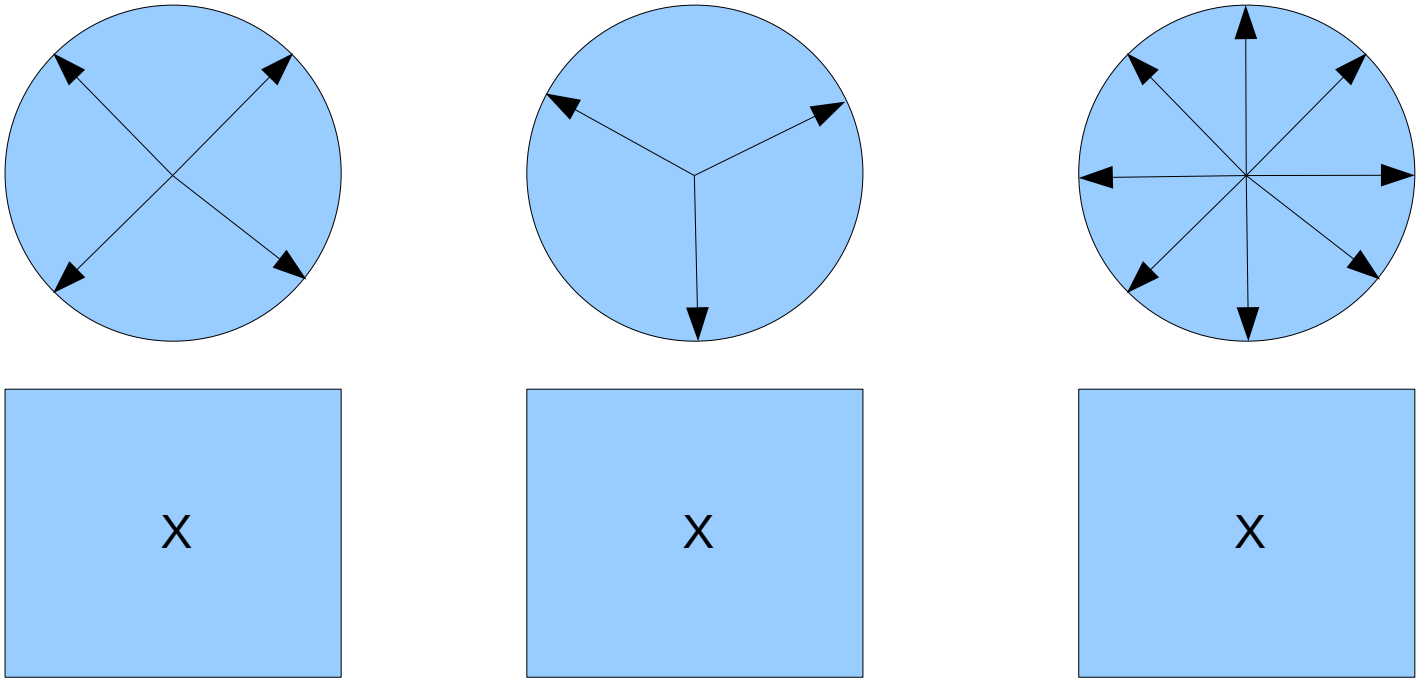
- Goal: find factors of large integer N = p * q
- Let's assume we've made our superposition
  - x mod N, x^2 mod N, x^3 mod N, x^4 mod N, ...
- So, given a superposition of elements in a periodic sequence, how do we extract the period?
  - If we find it, Euler gives us (p-1)(q-1), and we win
- We use the **Quantum Fourier Transform**
  - The heart of **Shor's Algorithm** (1994)
- Reasoning by analogy time!

Groundhog Day

- You're on a 27 hour day.
- Let's imagine that your bedroom has many clocks in it
  - One clock has 27 hours per day
  - One clock has 3 hours per day, etc.
  - Each hour is still 60 minutes on all clocks
- Each clock has its own posterboard with a thumbtack in it – mounted right below the clock
  - When you wake up, you move each thumbtack in the direction of its clock's hour hand

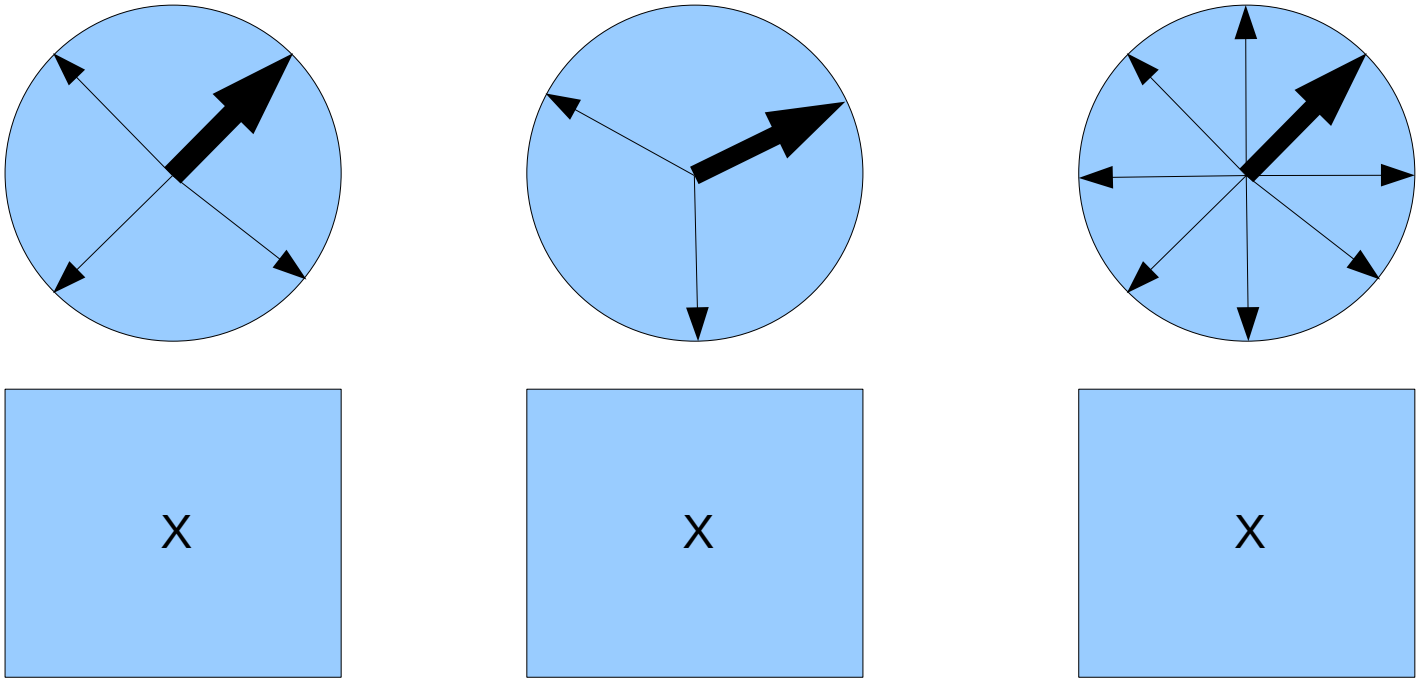
Bedroom Of Doom!

- Three of your clocks: 4-hour, 3-hour, 8-hour:



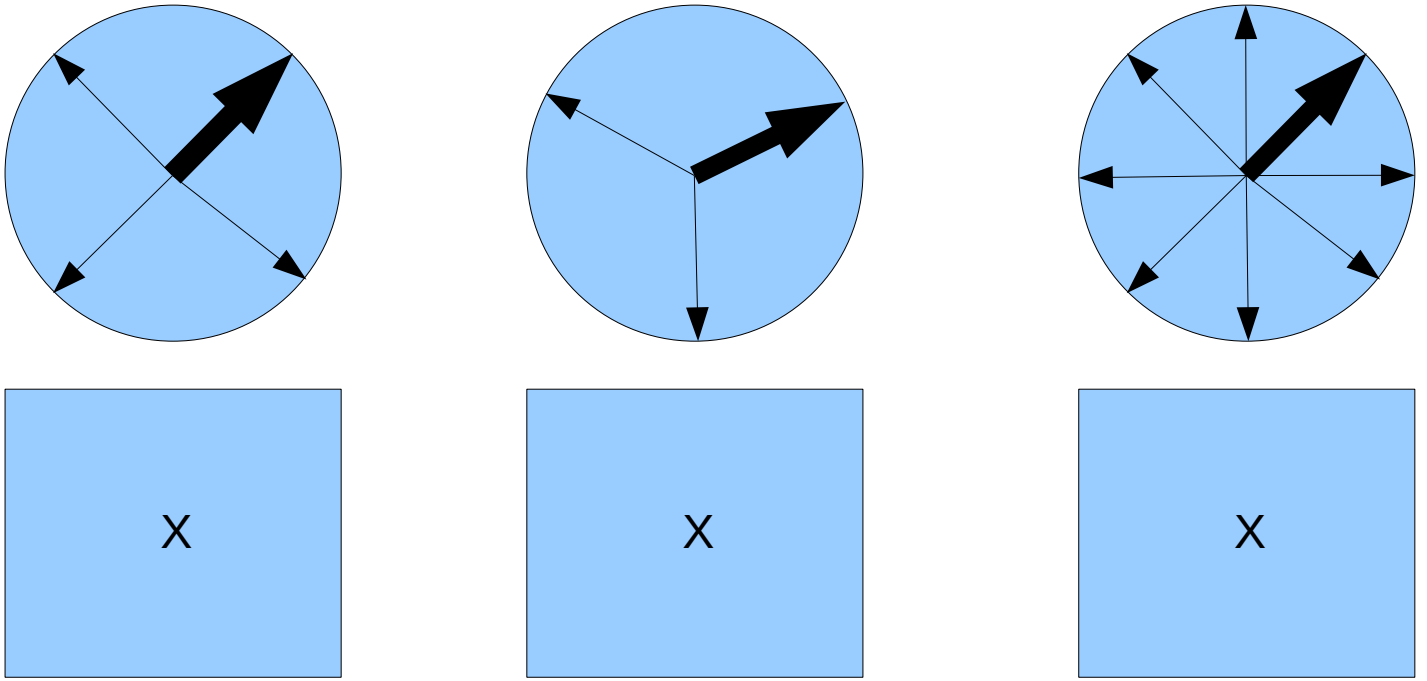
Bedroom Of Doom! (1pm)

- Let's say the current time is 1pm on all clocks.



Bedroom Of Doom! (1pm)

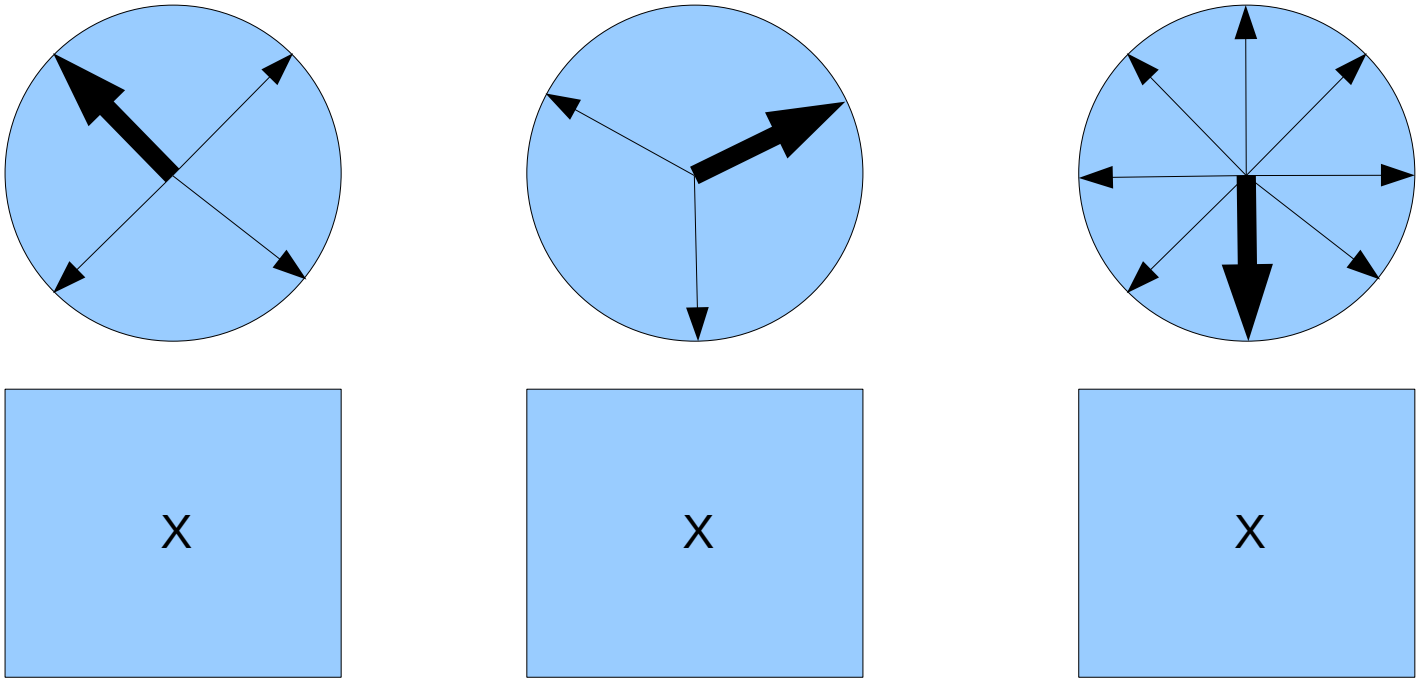
- Let's say you're on a 3-hour day, so you wake up every three hours.



- So when next you wake up, it'll be three hours later ...

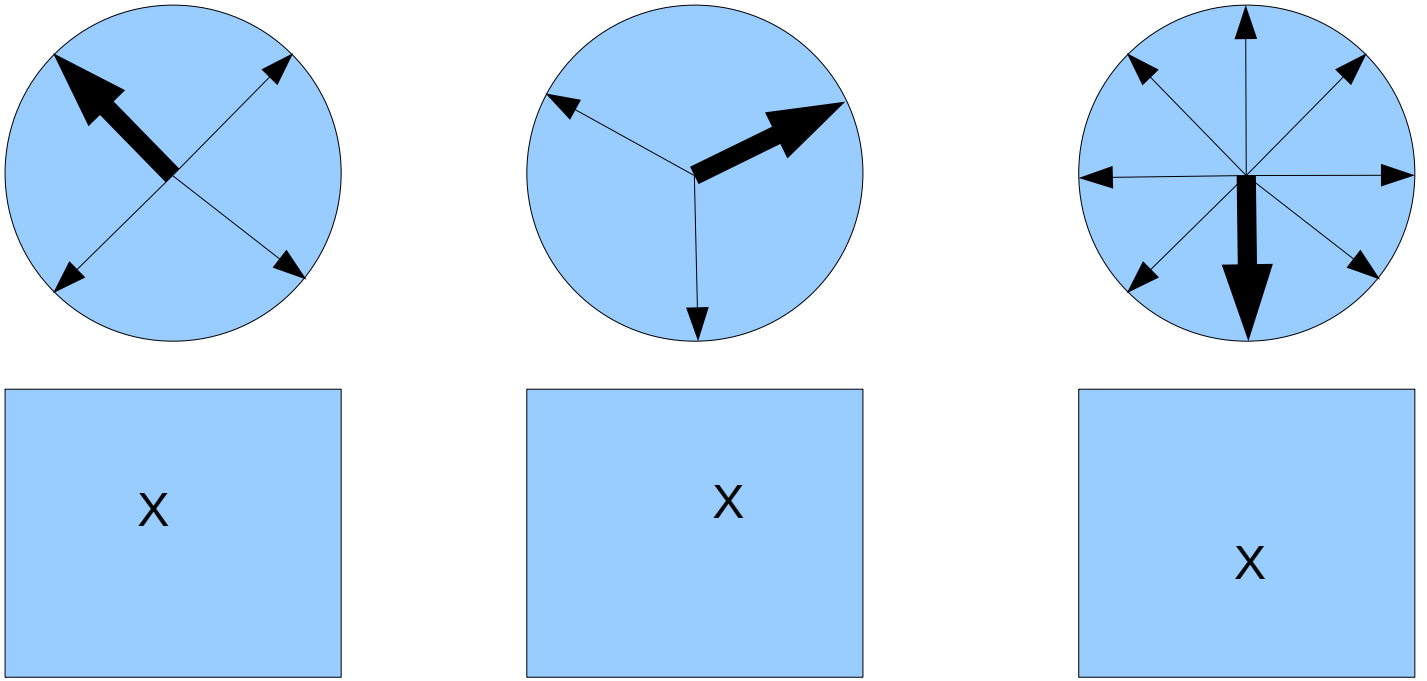
Bedroom Of Doom! (4pm)

- So you adjust the clocks



Bedroom Of Doom! (4pm)

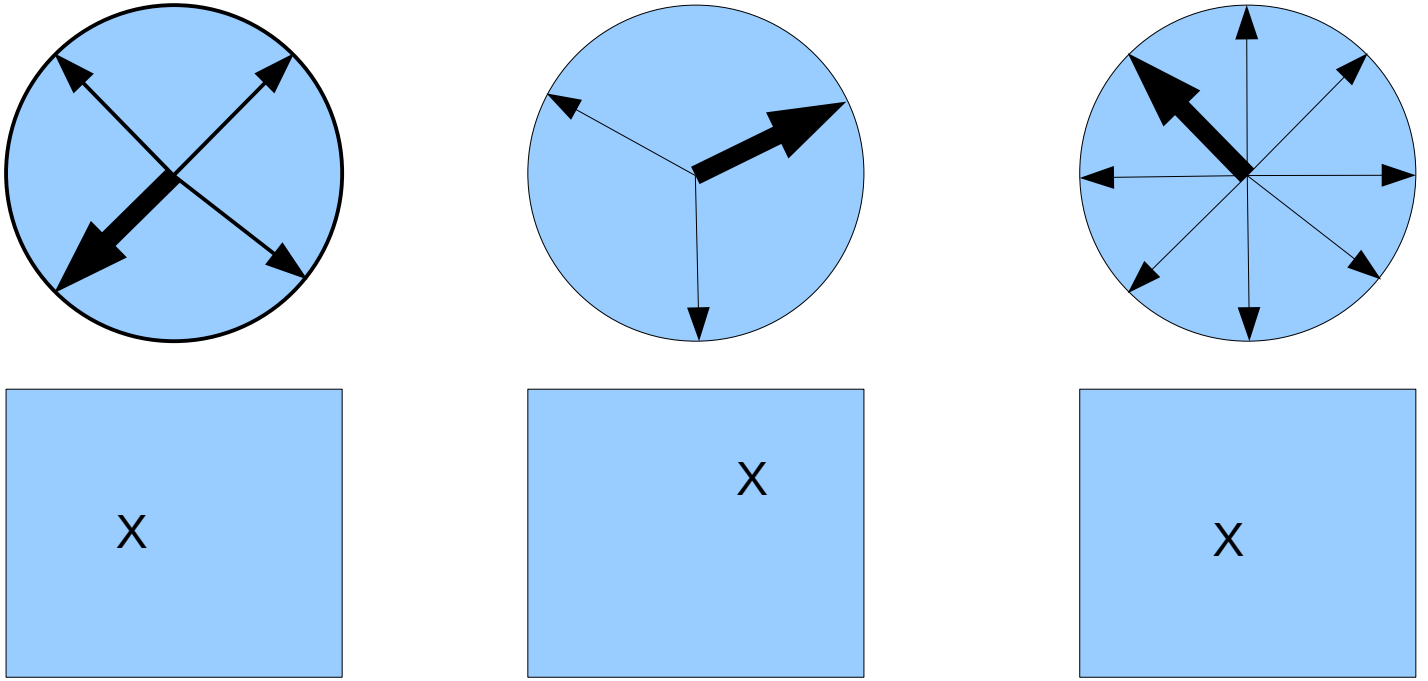
- So you adjust the clocks



- And move the thumbtacks ...

Bedroom Of Doom! (7pm)

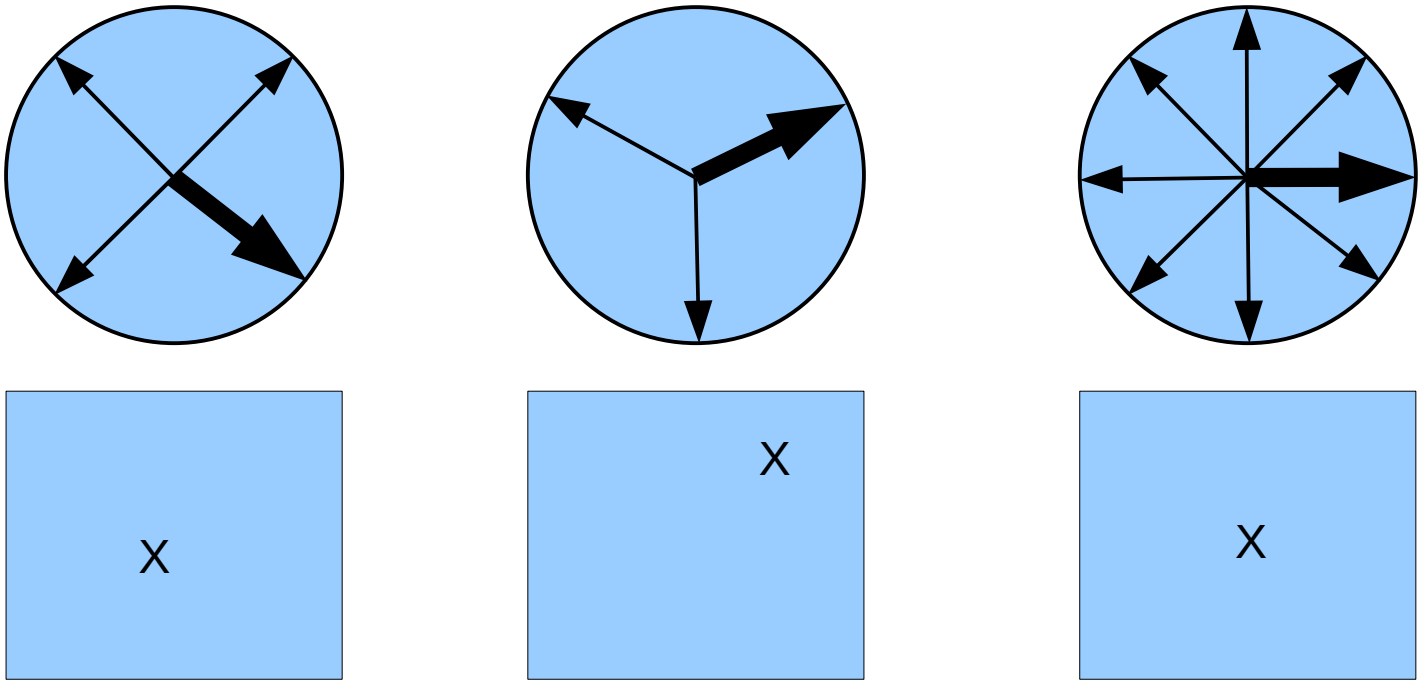
- Wakey Wakey! So you adjust the clocks



- And move the thumbtacks ...

Bedroom Of Doom! (10pm)

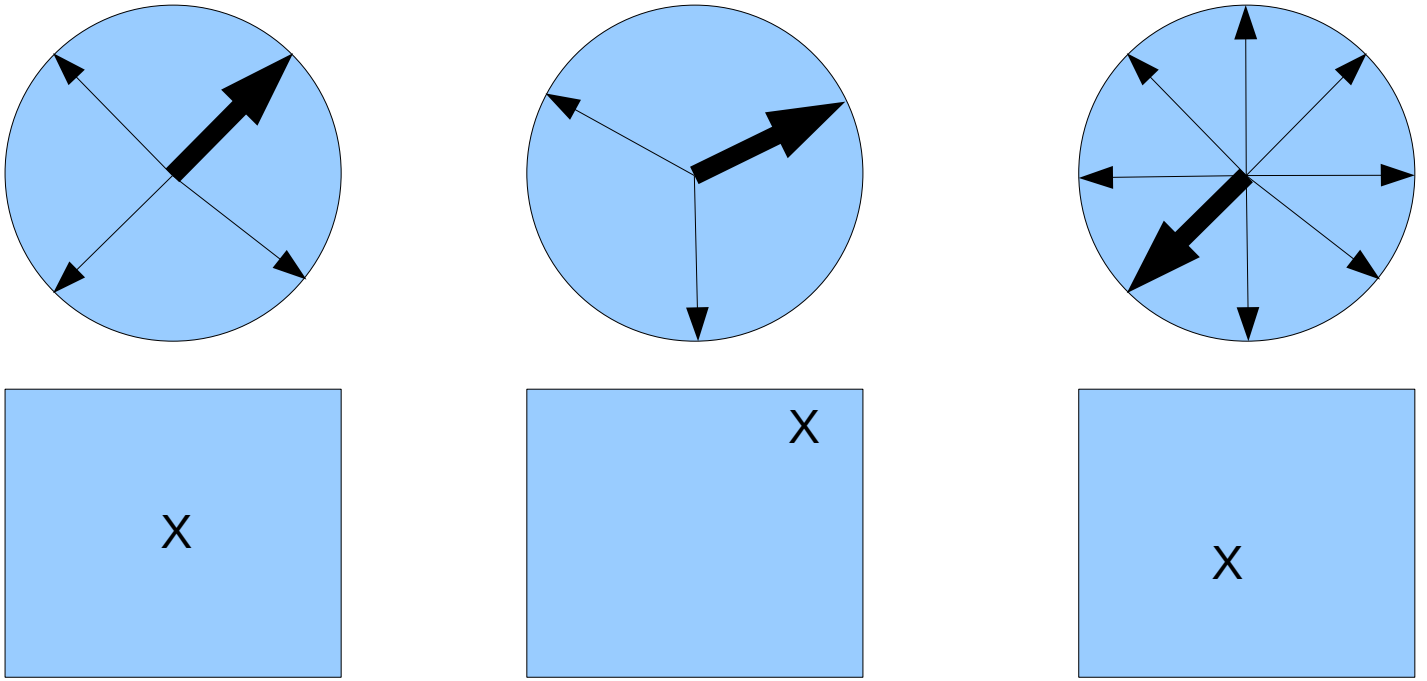
- Wakey Wakey! So you adjust the clocks



- And move the thumbtacks ...

Bedroom Of Doom! (1am)

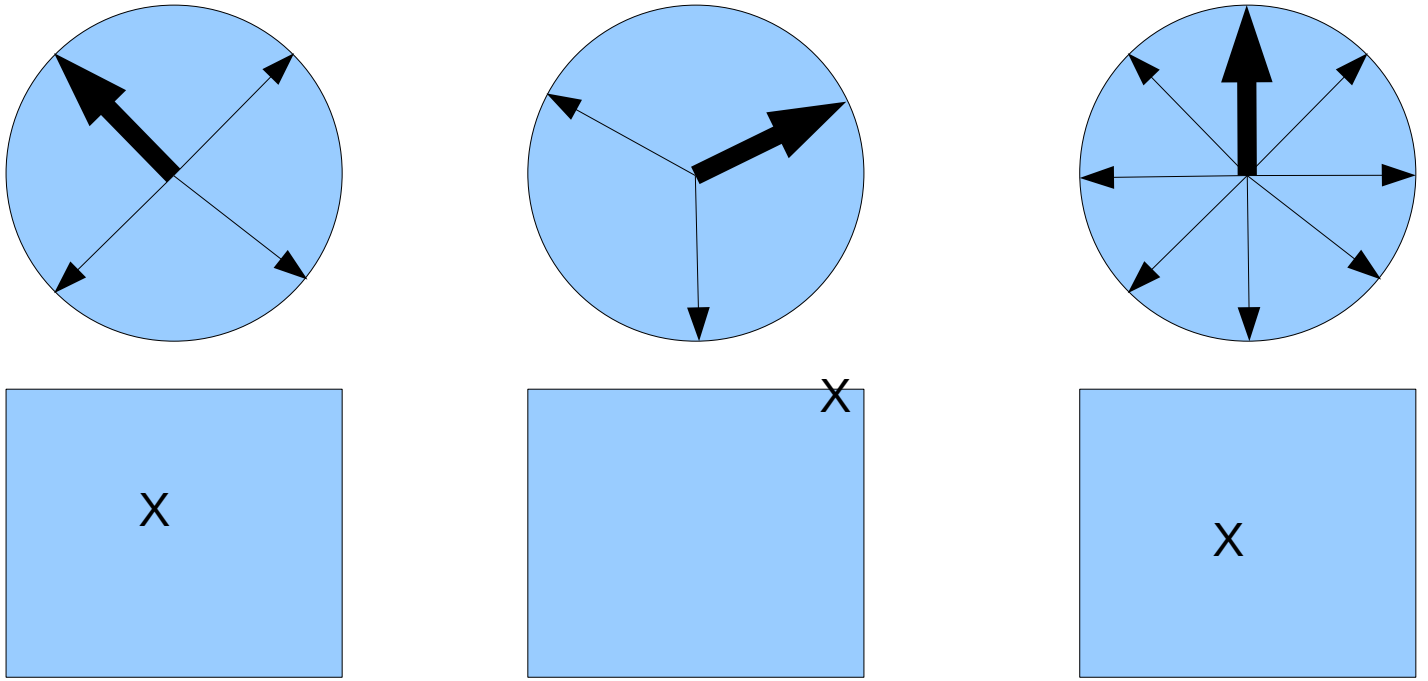
- Sigh! So you adjust the clocks



- And move the thumbtacks ...

Bedroom Of Doom! (4am)

- Sigh! So you adjust the clocks



- *How can you tell which clock matches your period?*

Periodic Motion

It's Just A Jump To The Left

- If you're on a 3-hour day, the 4-hour clock's thumbtack drifts around a little, but every few days it returns to the center
  - All of the movements cancel each other out!
- On the other hand, from the perspective of the 3-hour clock you've been waking up at the same time each “morning”
  - **So you keep moving that thumbtack in the same direction!**
- So just find which thumbtack is farthest from the center and you've found the period.

QFT, QED.

- The **Quantum Fourier Transform** is a linear (unitary) transformation that maps a vector of complex numbers to another vector of complex numbers
- Input vector has nonzero entries every time I wake up, zero entries everywhere else
- Output vector records thumbtack positions
- In the end: it's a linear transform mapping quantum state encoding a periodic sequence to a quantum state encoding the *period* of the sequence!

Interference

- In quantum-land, probabilities are always non-negative but **amplitudes** may be negative, positive or even complex.
- Thus amplitudes corresponding to different ways of getting a particular answer can **intefere destructively** and cancel each other out
- In Shor, all periods from all observations (i.e., all alternate universes) other than the true one cancel each other out. Only for the true period do contributions from all observations (i.e., all universes) point in the same direction.

Shor's Algorithm

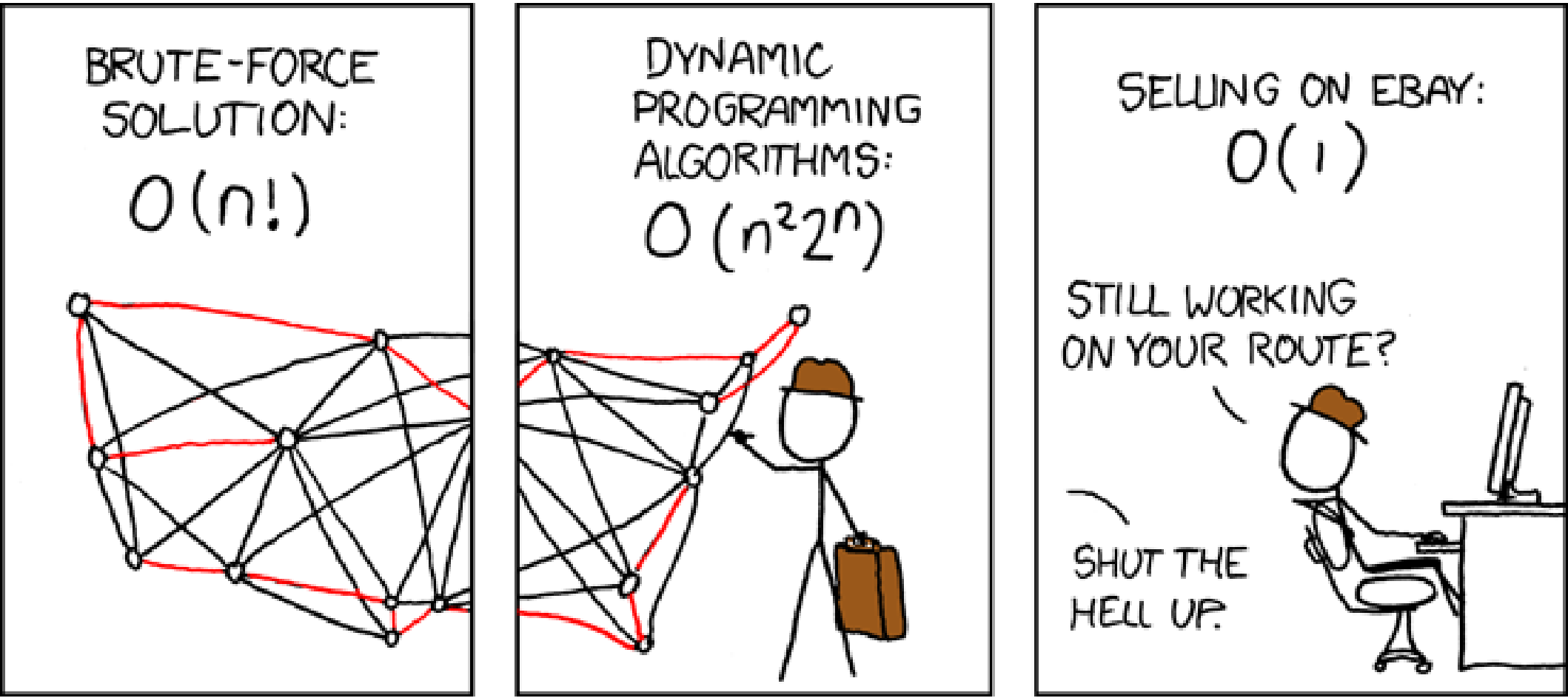
- On a quantum computer, **Shor's Algorithm** takes $O((\log N)^3)$ time to factor the integer N
  - Recall: best classical time ~$O(2^{\log N})$
- In 2001, a team at IBM implemented Shor's algorithm and factored 15 using 7 qubits
  - *Experimental realization of Shor's quantum factoring algorithm using nuclear magnetic resonance*
  - "We use seven spin-1/2 nuclei in a molecule as quantum bits, which can be manipulated with room temperature liquid-state nuclear magnetic resonance techniques."

Did We Win?

- A normal Turing machine can simulate a quantum computer (slowly ...)
  - So we do not gain any expressive power
  - Quantum computers do not solve the halting problem
- But quantum computers sure seem faster!
- The class of problems that can be solved efficiently by quantum computers is called **BQP** (bounded error, quantum, polynomial time).

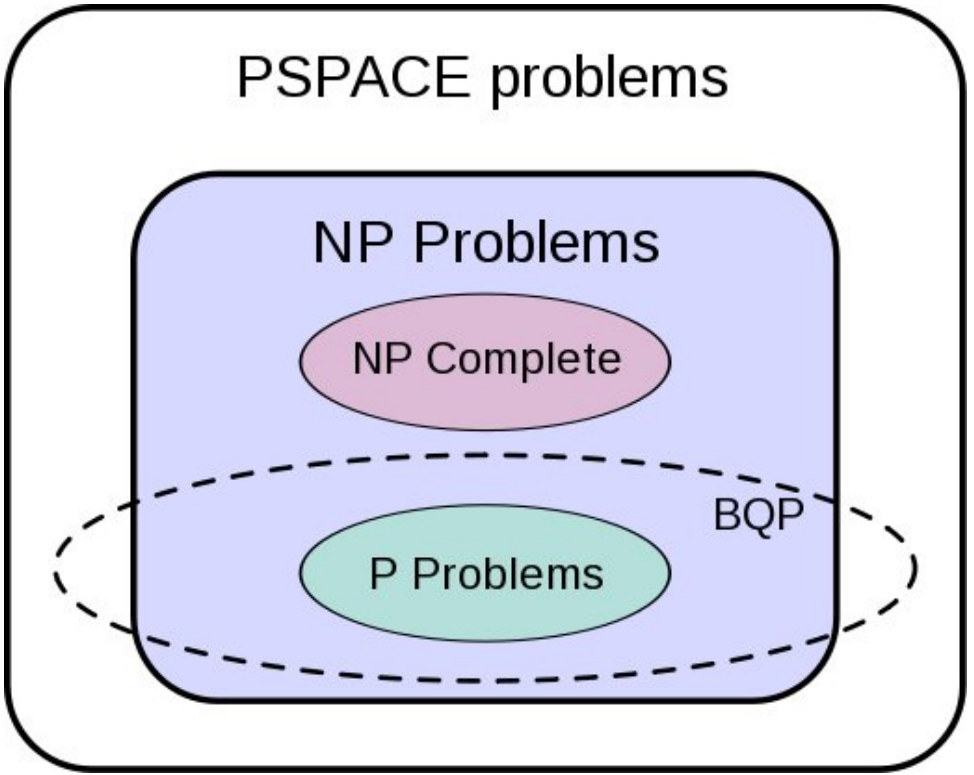
P = NP ?

- **So**: “quantum computers can solve NP-complete problems in polynomial time” ?



P = NP ?

- **Misconception**: “quantum computers can solve NP-complete problems in polynomial time”
- BQP is *suspected* to be a superset of P and disjoint from NP (this is *unknown*)



What Is Quantum Good For?

- BQP contains Integer Factorization
  - Believed to be in NP but not in P
- BQP contains Discrete Log
  - Believed to be in NP but not in P
- BQP contains Quantum Database Search
  - Can give an N^2 speedup on any NP-complete problem (by searching through all the answers), but that's still exponential time
- And that's currently about it.

Q: Movie Music (437 / 842)

- This most common word in the 1991 Disney song **Belle** remains the same in the French localization of the movie.

Q: General (481 / 842)

- In 1983 this man challenged the major findings of Margaret Mead, a famous cultural anthropologist, five years after she died. He based his highly questionable critique on four years of field experience and recent interviews with survivors of Mead's original study.

Q: Games (543 / 842)

- His genre-spawning 1993 game, "affectionately" referred to as "crack for gamers", was later inducted into the **GAMES Magazine** and **Origins** Halls of Fame. Name this game designer, who also holds a doctorate in mathematics.

Q: Events (607 / 842)

- This Palestinian "uprising", sometimes called "the war of the stones", began on December 8, 1987.

Q: Cartoons (663 / 842)

- Give all four Renaissance artist names chosen by Splinter the Rat for his four mutant ninja disciples in the 1984 comic book and 1987 cartoon.

Q: Books (731 / 842)

- This 1958 ursine children's book character was created by Michael Bond. He likes marmalade and is known for the railway station where he was found.

Q: Advertising (833 / 842)

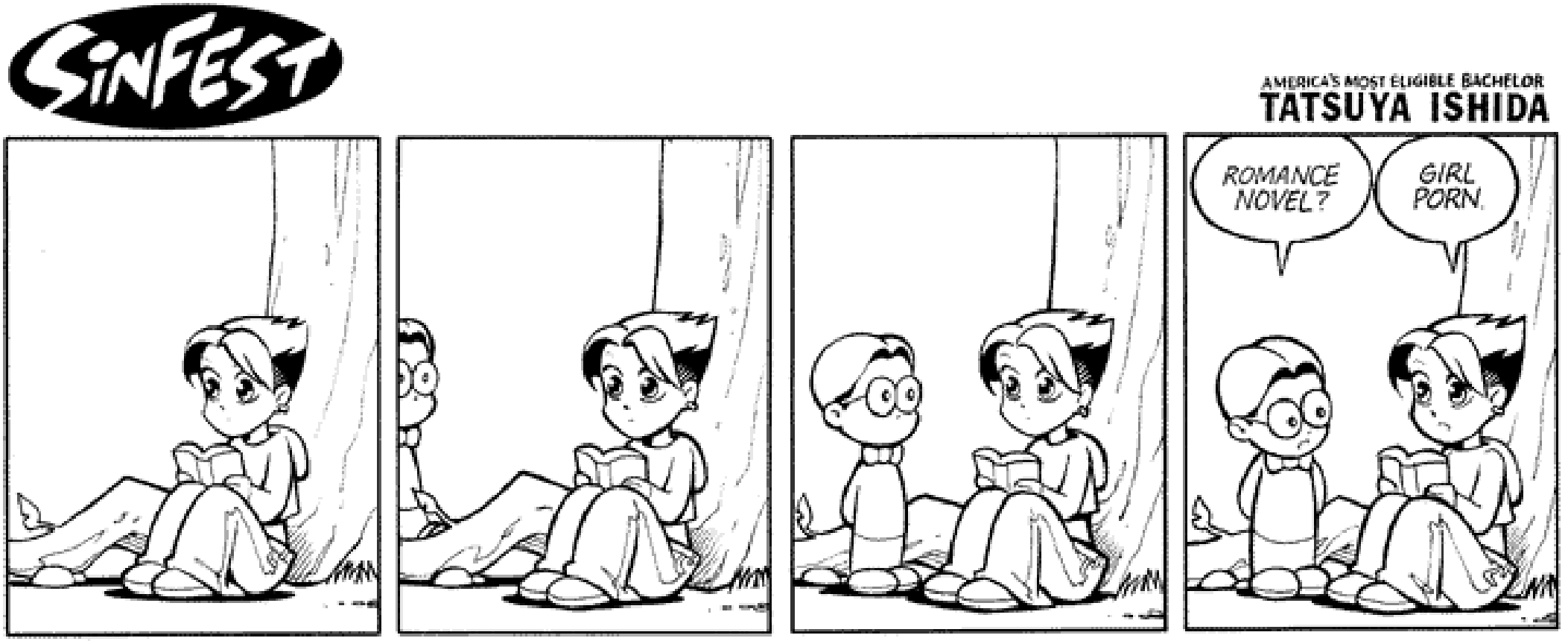
- This company's hosiery first came in plastic egg containers in 1970.

Q: Advertising (840 / 842)

- In their 1987 ad campaign The Partnership For A Drug-Free America used the phrase *"This is your brain. This is your brain on drugs. Any questions?"* What was used to symbolize *"your brain"* ? The ads were directed by Joe Pytka.

Dispelling Romance Novel Myths

- Tell me something about romance novels ...



Why Should We Care?

- In North America, romance novels comprise 55% of all paperbacks sold
  - Most popular genre in modern literature
  - And 39% of all fiction sold
  - Also Europe & Australia, over 90 languages, etc.
- In 2004, romantic fiction generated $1.2 billion in sales (2285 separate novels that year)
  - 64 million people claimed to read at least one in 2004 (up 21% from 2001)
  - 22% male, 50-50 married/single, 42% BA/BS
  - 28/190 world countries have GDP < $1.2 billion

What Are We Talking About?

- According to the Romance Writers of America, the main plot of a **romance novel** must revolve around the two people as they develop romantic love for each other and work to build a relationship together. Furthermore, a romance novel must have an "emotionally satisfying and optimistic ending."
- Nora Roberts claims "The books are about the celebration of falling in love and emotion and commitment, and all of those things we really want."

Freedom?

- Modulo societal taboos, almost anything can appear in a romance novel.
  - Castles, domestic violence, science fiction, disabilities, children, religion, date rape, medicine, suspense, exotic locales, chaste kisses, etc.
- So let's do a brief history and taxonomy of romance novels and occasionally use them as a lens for studying society

Ancient History

- 1740: Pamela, or Virtue Rewarded by Samuel Richardson
  - First popular novel based on heroine's perspective
- 1813: Pride and Prejudice by Jane Austen
  - Often critically considered “the best romance novel ever written”
  - Reinforces stereotype that women must marry?
- 1847: Jane Eyre by Charlotte Bronte
  - Orphaned heroine, gothic elements, Elizabethan drama, “demonstrated the flexibility of the romance novel form”

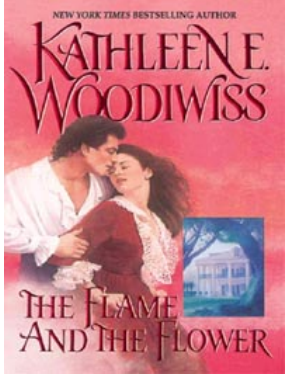
History

- 1919: The Sheik by E.M. Hull
  - Popular, movie with Valentino, hero kidnaps heroine and wins her affection through “forceful action”
    - One of the first to introduce the rape fantasy [Regis 2003]. Publishers believed that readers would only accept premarital sex in the context of rape. In this novel and those that followed, the rape was depicted as more of a fantasy; the heroine is rarely if ever shown experiencing terror, stress, or trauma as a result.
- 1921+: Many by Georgette Heyer
  - Set during English Regency Period (1811-1820)
  - Used setting as a plot device: characters would have modern day sensibilities (e.g., marrying for love) and would be marked as eccentric

Pre-Modern Era

- 1930+: Mills and Boon hardback romances
  - UK Company, sold in weekly two-penny libraries
- 1957: Harlequin sells M&B books in America
  - Had a “decency code”
    - cf. Hays Production Code in US Cinema, 1934-1968: replaced in modern era by MPAA ratings
    - Intimacy limited to chaste kisses between protagonists
- 1971: Harlequin purchases Mills & Boon
  - Chose to sell books “where the women are”: supermarkets, drug stores, etc.

The Modern Era



- 1972: The Flame and the Flower by Kathleen Woodiwiss (Avon publishers)
  - First romance novel “to [follow] the principles into the bedroom”; first to be published directly in paperback; was distributed in drug stores; went on to sell 2.35 million copies
- By 1975 Avon's 4 romances sold 8 million combined copies
- By 1976 over 150 historical romance novels were published selling over 40 million copies

Two Types Of Romance

- **Category Romances** (series romances)
  - Short: 200 pages; 55,000 words; multiple books in a line published each month
  - “pare the story down to its essentials. Subplots and minor characters are eliminated or relegated ...”
  - Wide distribution, staying on shelves until sold out or until next month's titles arrive
- **Single-Title Romances**
  - Longer: 350-400 pages, 1/year, remain on shelves
  - Not always stand-alone, often Author-driven

Subgenres

- 40% Category Romance
- 17% Historical Romance
- 16% Contemporary Romance
- 9% Paranormal Romance
- 7% Romantic Suspense
- 6% Inspirational Romance
- 5% Other

Social Mores: Romance Novels 1980s

- 1980: WSJ refers to “bodice-rippers” as “publishing's answer to the Big Mac: they are juicy, cheap, predictable, and devoured in stupifying quantities by legions of loyal fans”
- Contemporary romances: weak females falling in love with alpha males
- Historical romances: heroines active in the plot, but “passive in relationships with heroes”
- All genres: heroines 16-21 virgins, heroes ~30 not, all are beautiful

The Sun Also Rises And Falls

- 1975: Harlequin purchases a romance novel that takes place in America with American morals
  - In the late 70's they rejected Nora Roberts because "they already had their American writer"
- 1980: The Tawny Gold Man by Amii Lorin
  - First to waive the virgin heroine requirement
  - By 1983, sales of that line totaled $30 million
  - Similar lines soon had 90-100% monthly sellout rates
- 1984: Market Saturation (40% sellout rates)
  - "dampening effect of the high level of redundancy associated with series romances was evident in the decreased number of titles being read per month"

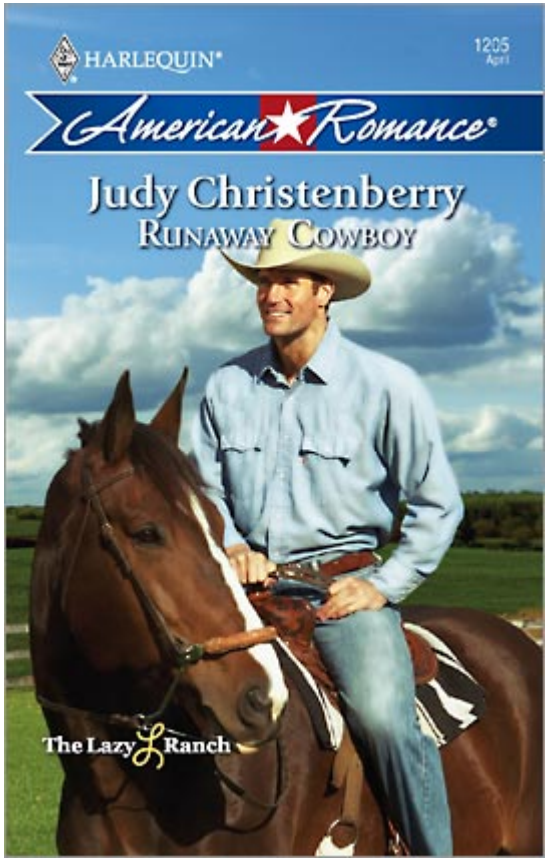
Social Changes

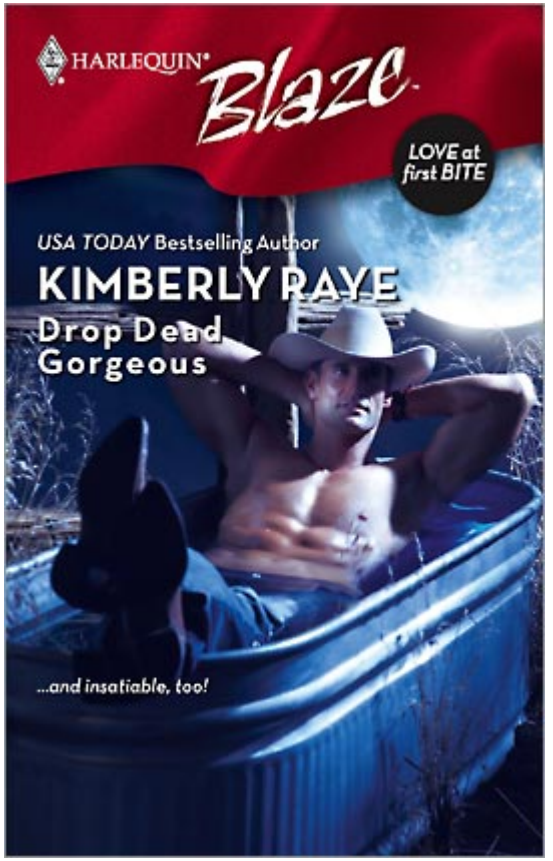
- 1984: overweight, middle-aged hero
- 1987: ugly hero, heroine searching for birth mother
- Late 1980's: heroines in more male-dominated jobs
- 1990's: self-employed heroines, 30-40 year old women, sensitive men
  - Later: single parenthood, adoption, abuse
  - Taboos: terrorism, warfare, masculine sports
- Now: what is **chick lit**?

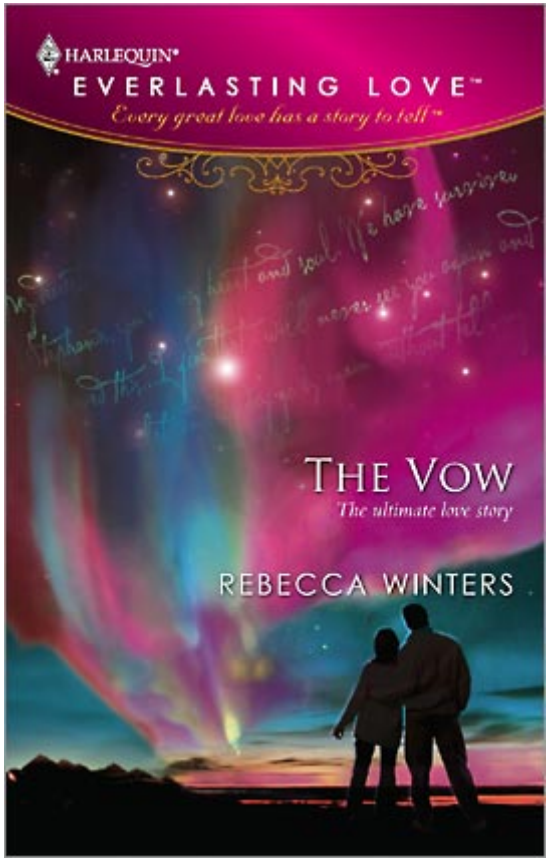
Category Romance

- Now the fun part ...
- I'll show you a bunch of different category romance lines
- You try to identify the **subgenre** and **target audience**

Category Romance In Pictures







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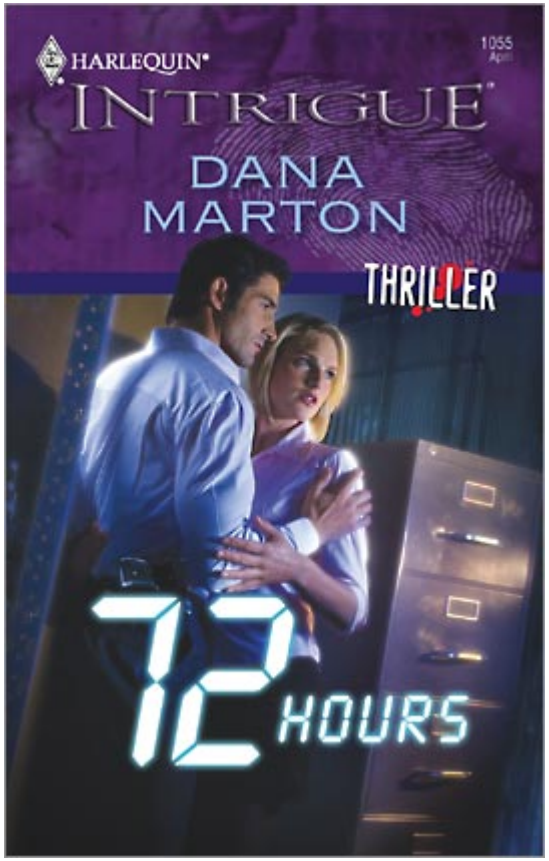

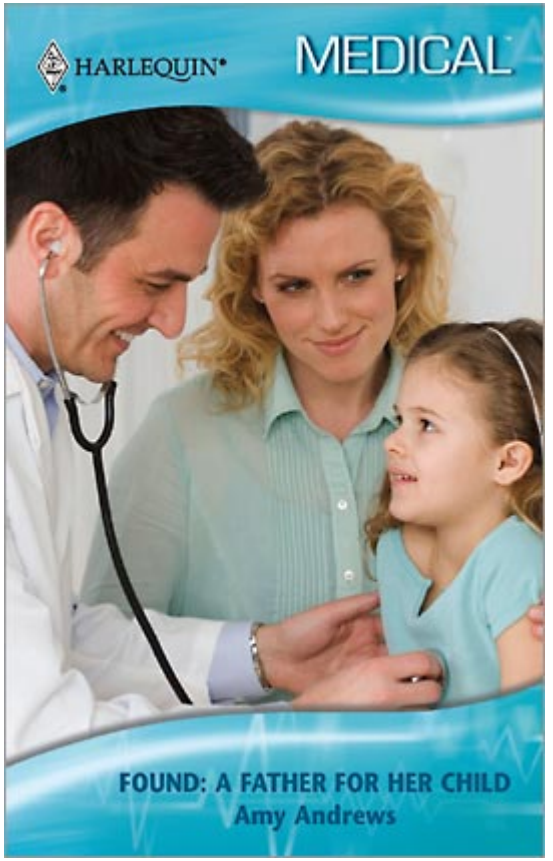

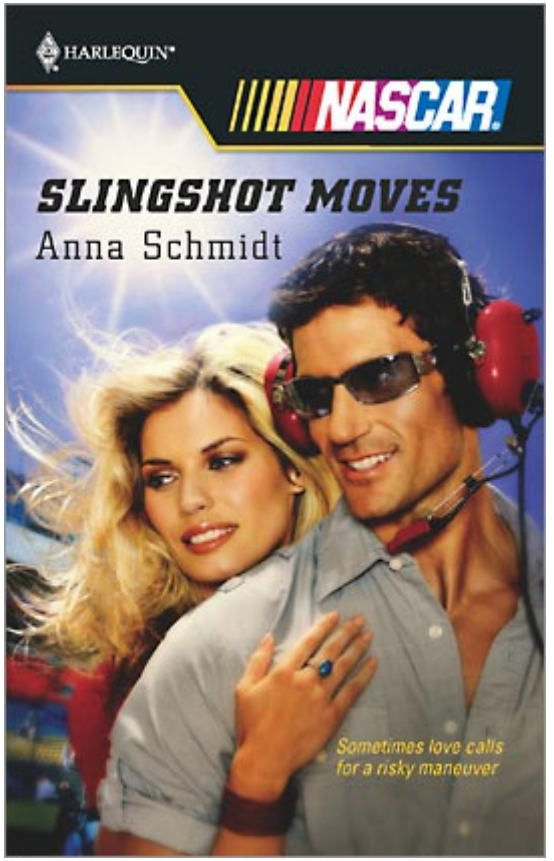

November 7, 2005: ThreatDown - Pirates

Monday, November 7, 2005

ThreatDown - Pirates

Stephen warns us about pirates, Canadian optometrists, professional musicians, mixing romance with NASCAR, and of course, bears. (3:48)

Views: 2,601
Posted: 11/07/2005
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books, bears, ThreatDown, Canada, Lewis Scooter Libby, NASCAR See All Tags >

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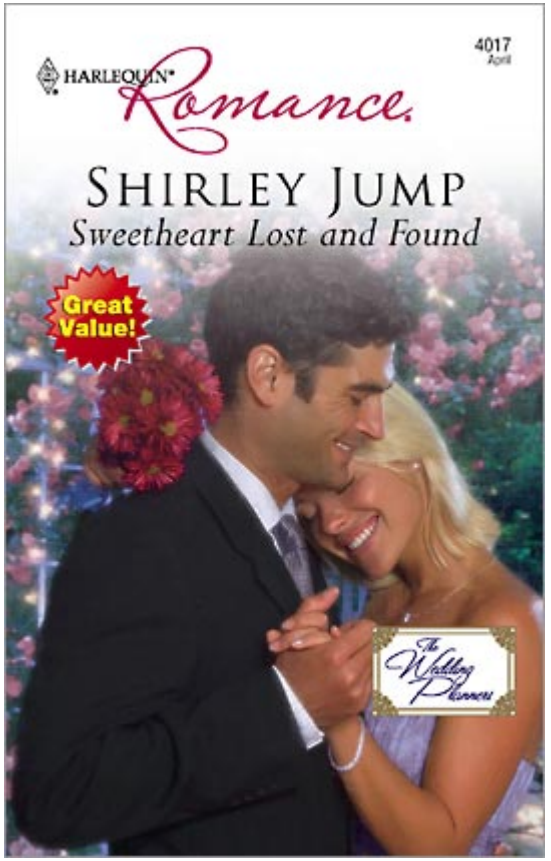
Monday, November 7, 2005
Eliot Spitzer
Stephen speak with governor-hopeful Eliot Spitzer about campaign costs, his chances of winning and if he agrees that bears are a major threat. (6:22)
Tags: interview, elections, money

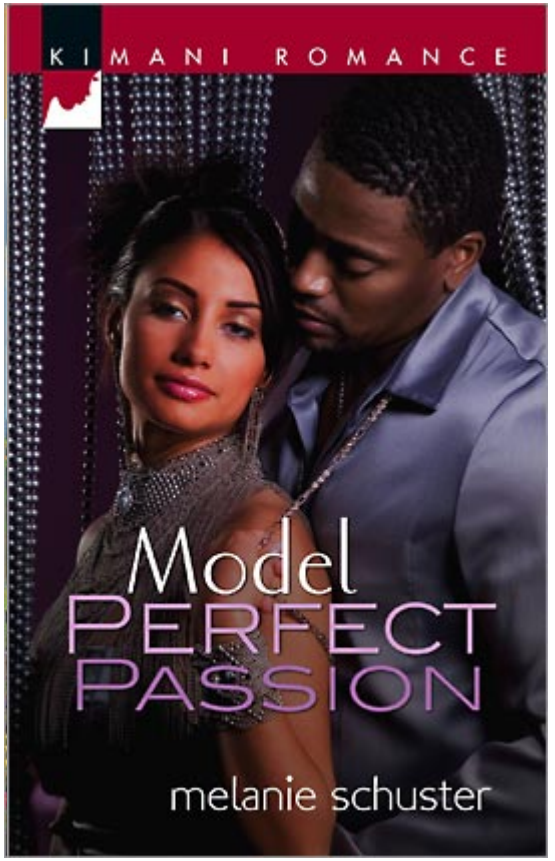
Monday, November 7, 2005
ThreatDown - Pirates
Stephen warns us about pirates, Canadian optometrists, professional musicians, mixing romance with NASCAR, and of course, bears. (3:48)
Tags: books, bears, ThreatDown

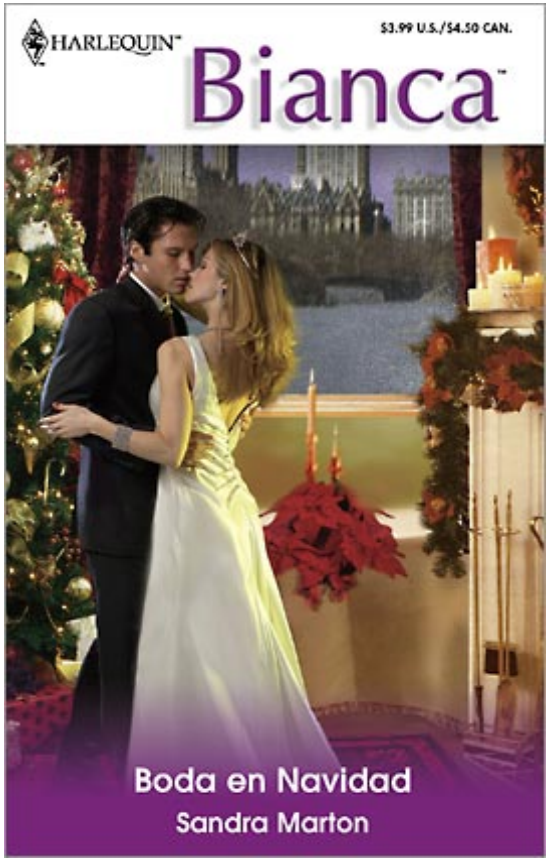
Monday, November 7, 2005
The Word - Hoser
After Canada picked up The Colbert Report, Stephen began to rethink his ill feelings towards the country

Comments

Category Romance In Pictures







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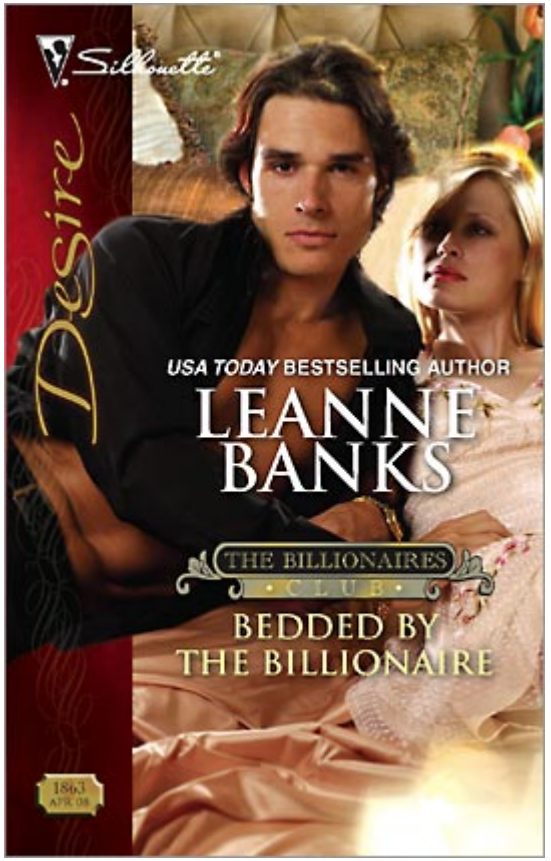

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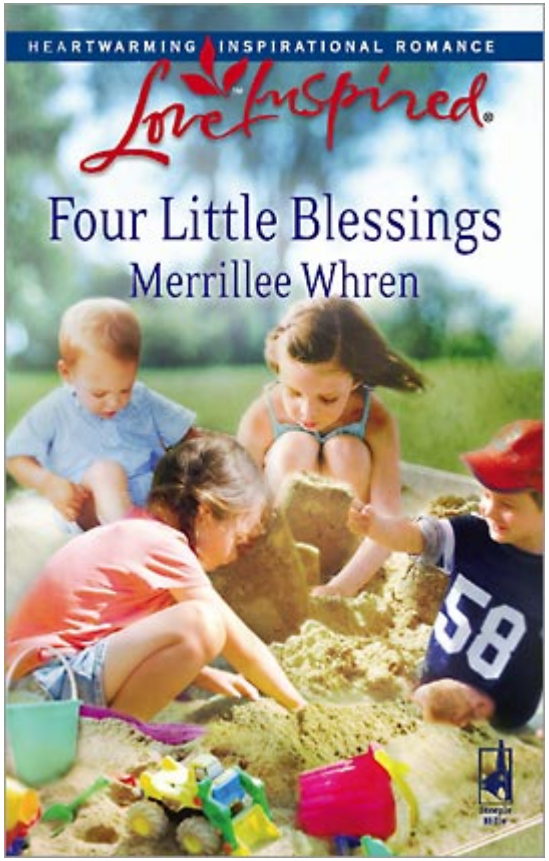

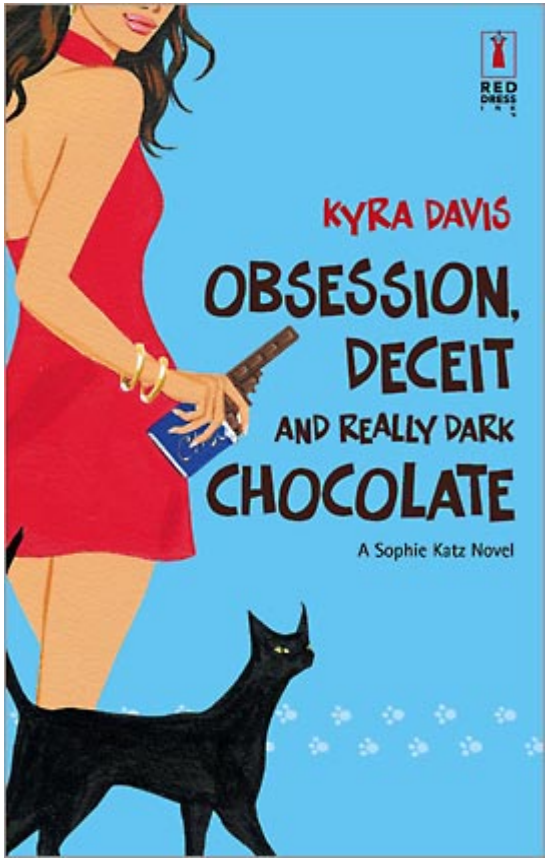

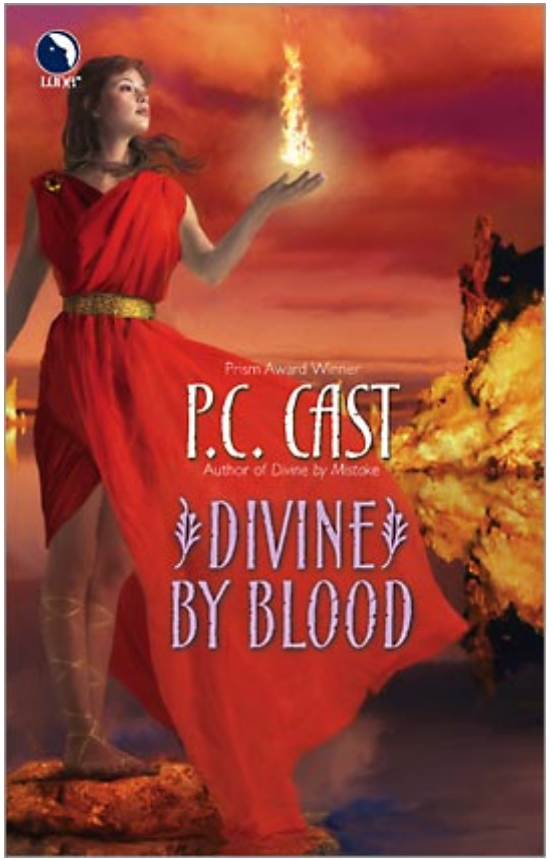

Future of PL and Computing

- Quantum Computing, Biological Computing
  - Not for many years. Theory but no practice.
- Model-Based Development
  - No. COTS: Yes. Problem: |spec| > |program| ...
- Embedded Computing
  - Big deal. Problem: C, classic compiler opts, ...
- Multicore + Manycore
  - Big deal. Problem: can't write parallel programs ...
- **Correctness + Maintainability > Performance**

Conclusion

- **Programming Languages** is the topic of ultimate mastery
  - It combines rigorous theory
  - With the best parts of industrial practice
  - It is the cosmic mayonnaise that holds CS together
- This class is difficult (and also curved)
- Good job sticking it out!