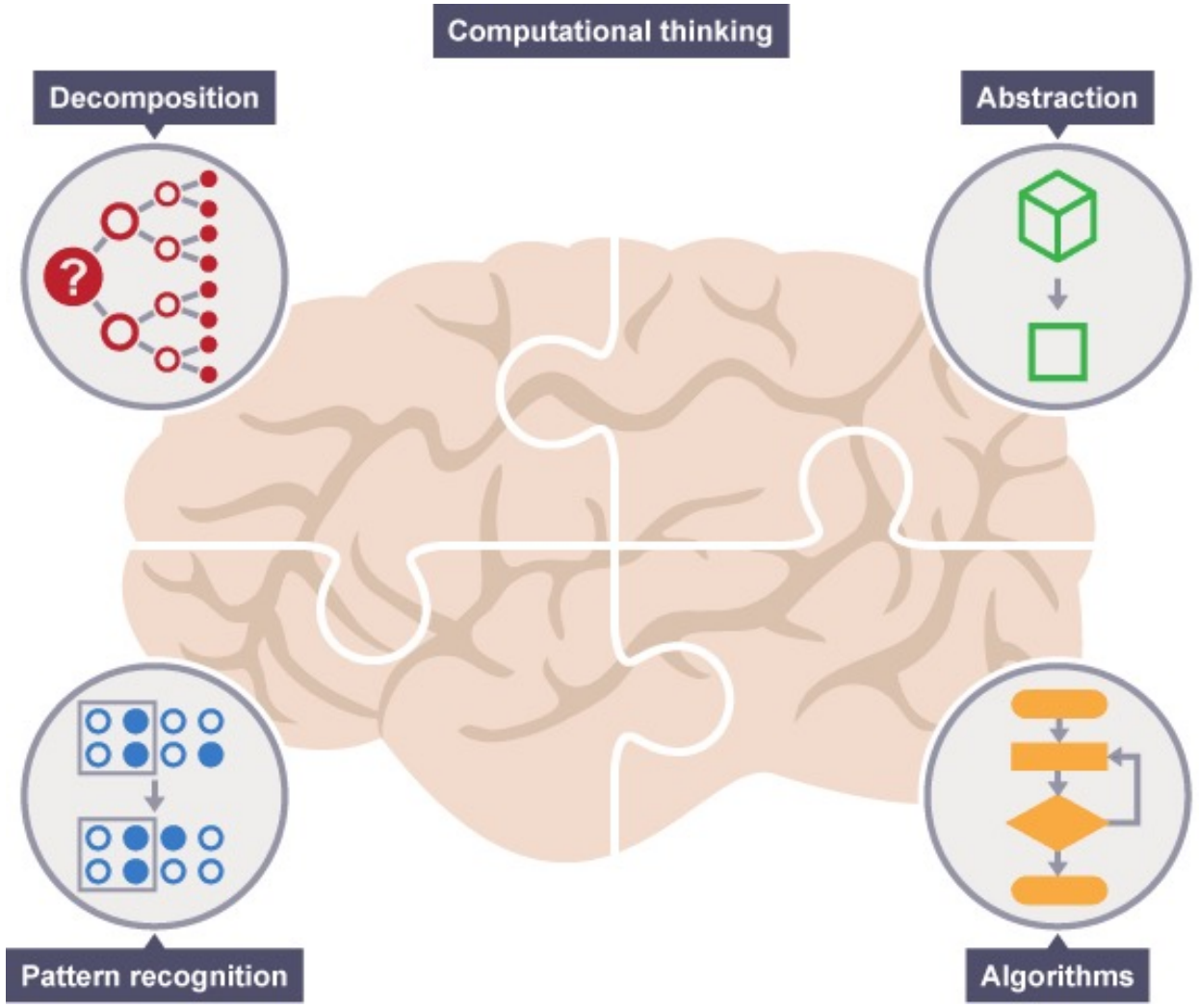
2019

Unit 12

Forrest J. Bowlick
University of Massachusetts Amherst, fbowlick@umass.edu

Computational Thinking

UMassAmherst



Forrest J. Bowlick,
Intro GIS

UMASS, Fall 2018

But First!

- Forms
- Posters
  - Designing
  - Making
- Exporting
  - Images
  - PDF
- Thinking

Google Forms

- Sign up for a printing slot! Deadline: 5pm TODAY
- Express your interest to be a TA! Deadline: Noon, Tomorrow!
  - tx.ag/S19TA
- Sign up for a presentation time!
  - Tx.ag/GISTime

Final Poster Content

- Scientific papers/reports/presentations have a very specific organization

  - **Introduction** Tells us why the topic is interesting;
  - **Methods** Tell us what you did;
  - **Results** Tell us what you found;
  - **Discussion** Tells us why what you found matters.

Consider this organization for your final poster

Final Poster Content

Introduction

Information to include:

- Why is the topic important?
- Brief background info that others might not know;
- Your motivating question.

Figures to include:

- Your study area map;
- A picture (if applicable).

Final Poster Content

Methods

Information to include:

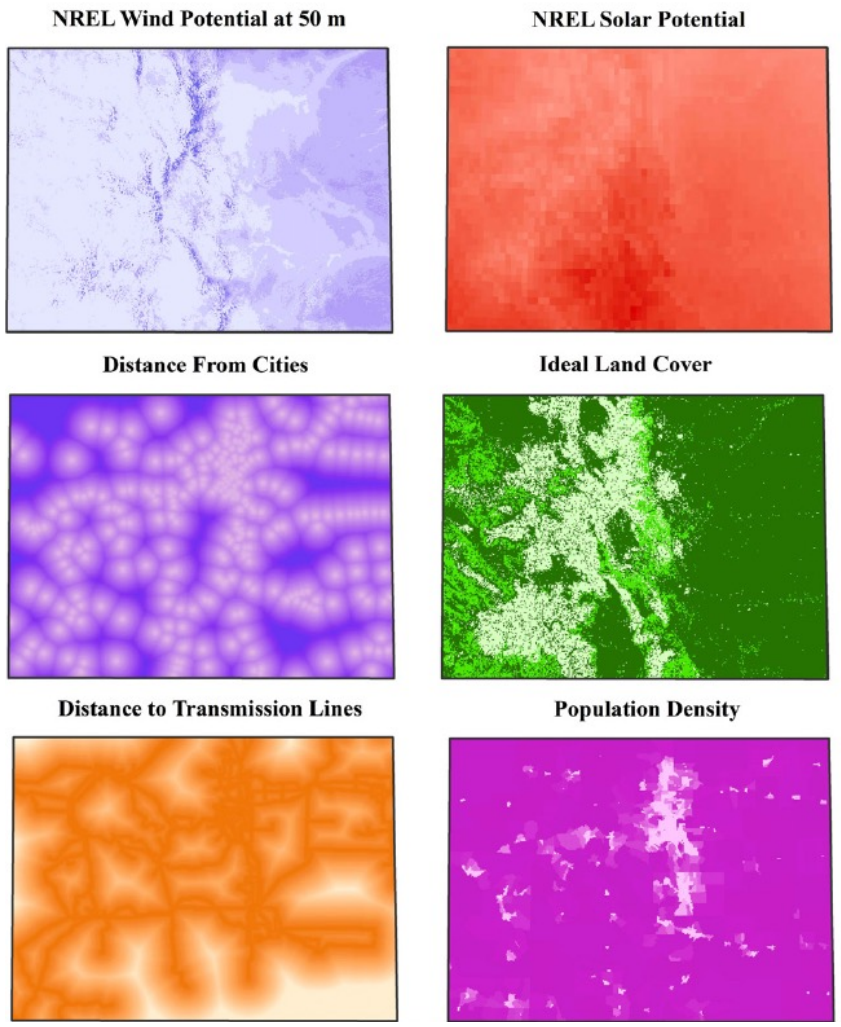
- General steps in your methodology
- Important decisions you made in your analysis
- Use bullets

Figures to include:

- Any methods steps you want to highlight
-Table of data layers

Final Poster Content

Methods



Janke, 2010

Figures to include:

- Any methods steps you want to highlight
- Table of data layers
- Keep them small (but not too small), your results should be the real focus

Final Poster Content

Results

Information to include:

- Description of any final maps or analytical results (maps, charts, text, etc.)

Figures to include:

- Final results map(s)
- Other results figures (e.g., histograms or scatter plots)

Final Poster Content

Discussion

Information to include:

- A summary of any important take home points from your analysis;
- What these findings might mean for the topic, or how your analysis/description/data collection (etc.) matters in this context.
- Future steps you could take;
- Notable limitations in your analysis.

Ivory Billed Woodpecker Conservation

Your Name Here
Department of Environmental Conservation
UMass Amherst

Introduction:
Text about why bird conservation is important and some history on the ivory billed woodpecker (Figure 1). Define your question here.

Fig. 1: Woodpecker

Methods:
Criteria used to define woodpecker habitat. How you did what you did (Figures 2-4).

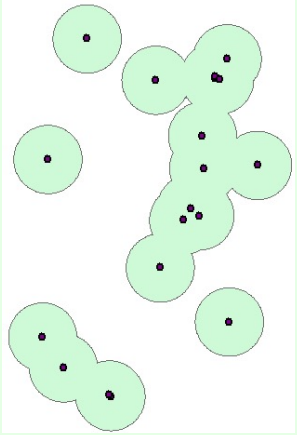


Fig. 2: Buffer

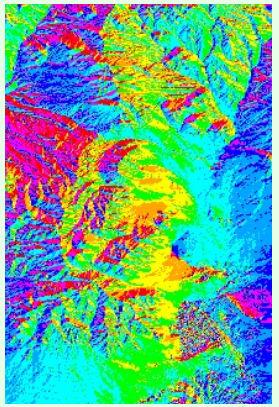


Fig. 3: Aspect

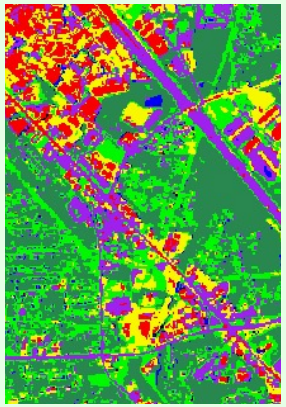


Fig. 4: Land Cover

Results & Discussion:
Woodpecker habitat. Final map or maps, final analysis (Figures 5-6). Discuss why these results are interesting.

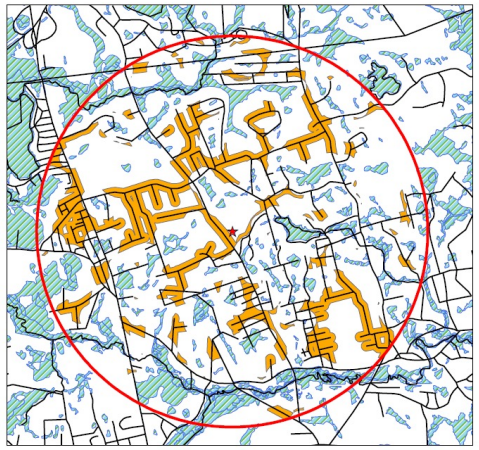


Fig. 5: Map result

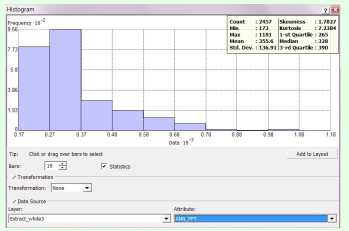
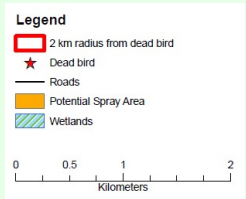


Fig. 6: Graph result



Ivory Billed Woodpecker Conservation

Your Name Here
Department of Environmental Conservation
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Introduction:

Text about why bird conservation is important and some history on the ivory billed woodpecker (Figure 1). Define your question here.

Fig. 1: Woodpecker

Methods:

How you did what you did (Figures 2-4)

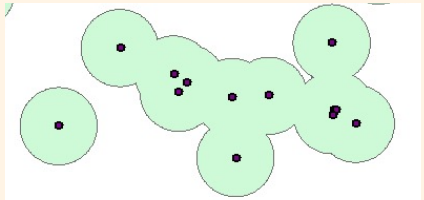


Fig. 2: Buffer

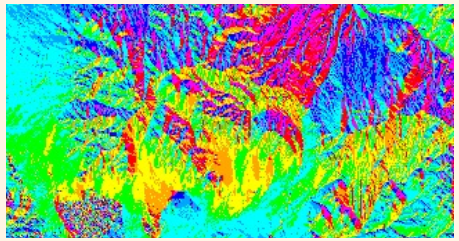


Fig. 3: Aspect

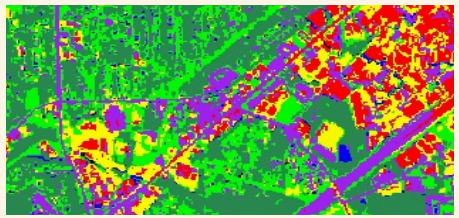


Fig. 4: Land Cover

Results & Discussion:

Final map or maps, final analysis (Figures 5-6). Discuss why these results are

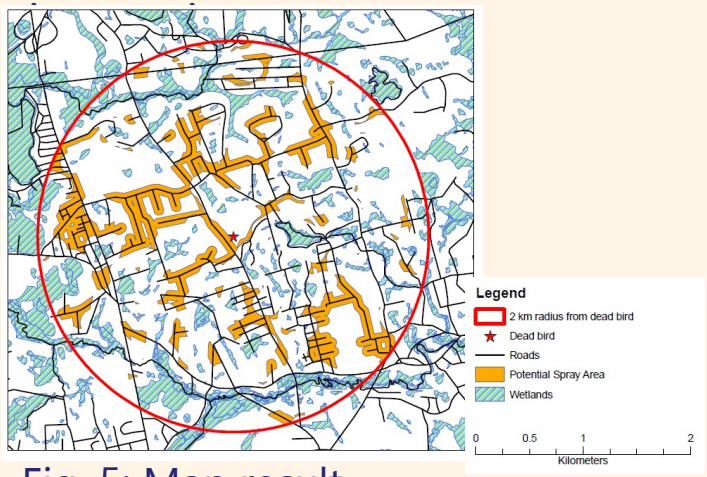


Fig. 5: Map result

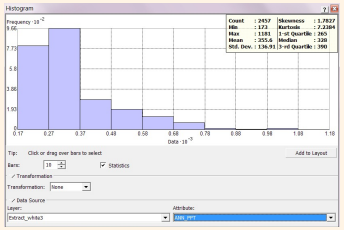


Fig. 6: Graph result

Ivory Billed Woodpecker Conservation

Your Name Here
Department of Environmental Conservation
UMass Amherst

Introduction

Why your topic is important (Figure 1). Define your question

Fig. 1: Woodpecker

Methods

How you did what you did (Figure 2)

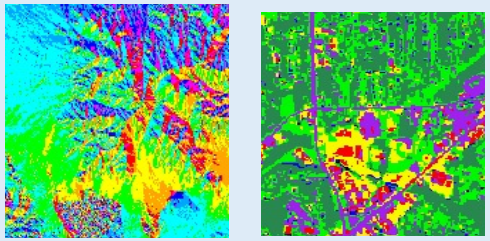


Fig. 2: Aspect & Land cover

Results & Discussion:

Final map or maps, final analysis (Figure 5). Discuss why these results are interesting

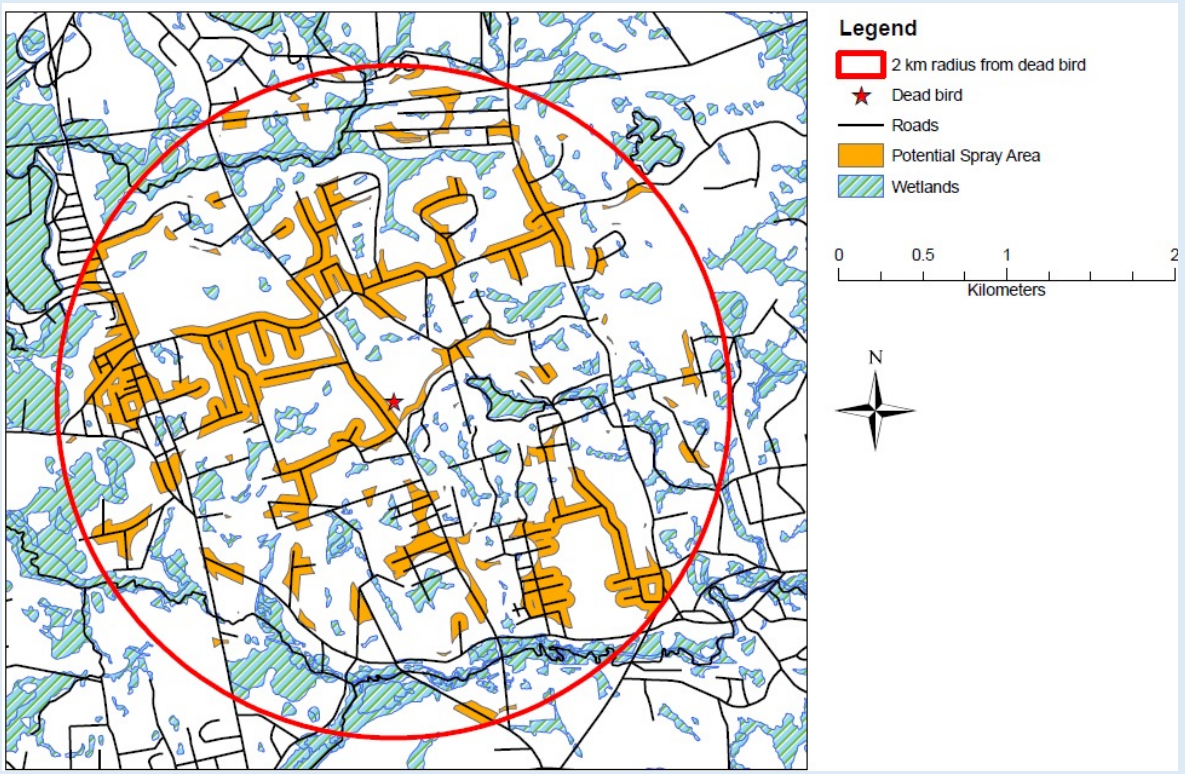


Fig. 3: Final awesome map

Lion Habitat Suitability Analysis based on Vegetation Type and Proximity to Water

Anna Garvin
Global Classroom – Big Cat Research Project

Introduction

Lions are a threatened species: habitat loss and conflict with humans has led to population decline over the last several decades. In 1950, there were an estimated 400,000 lions in the wild. By 2003, the number had fallen to somewhere between 16,500 and 47,000 lions. Something must be done about the conservation of these animals in order to prevent the species from suffering extreme endangerment and possible extinction.

Kruger National Park (Fig. 1) is one of the largest game reserves in Africa. Located in South Africa, it is home to around 2,000 lions. It is therefore an ideal place to study these big cats and determine how best to move forward with the conservation effort.

Figure 1: Study Area


Figure 2: Transvaal lion – *Panthera Leo krugeri*

Methods

Over the course of three summers my team collected observation data on the big cats of Kruger National Park. The bulk of our data focused on the Transvaal Lion – *Panthera Leo krugeri* (Fig. 2). We collected presence data, but not absence data. Additionally, data collection did not occur uniformly throughout the park: we spent more time in some areas than others. Because of the nature of our data, it was a challenge to analyze it objectively.

- Attained spatial vegetation data.
- Performed a count of lion, leopard, and cheetah numbers in each of the five vegetation types.
- Created a bar graph of raw numbers of cats in each vegetation type (Fig. 3).
- Created a pie chart for each vegetation type illustrating the ratios of lions to leopards and cheetahs (Fig. 6).
- Calculated nearness of cats to rivers and wetlands.
- Created a buffer around rivers and wetlands in areas of appropriate vegetation, using the mean distance of cats from bodies of water plus one standard deviation, assuming a log-normal distribution.

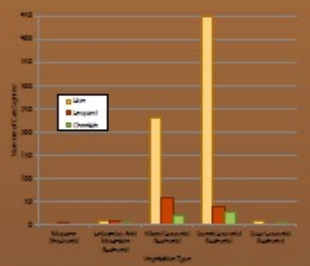


Figure 3: Count of cats in study area

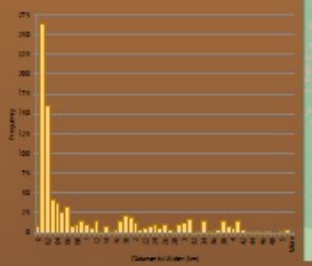


Figure 4: Histogram – distance of cats to water

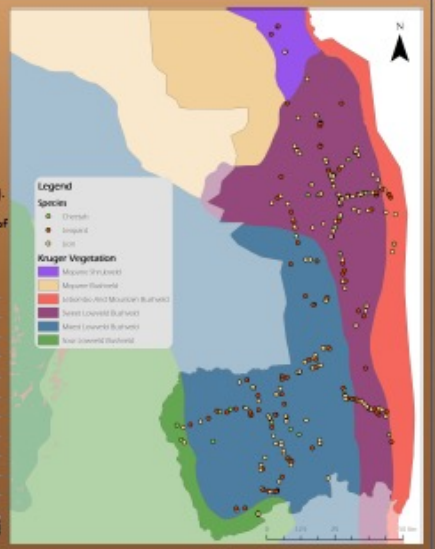


Figure 5: Cat sightings and vegetation types in Kruger National Park

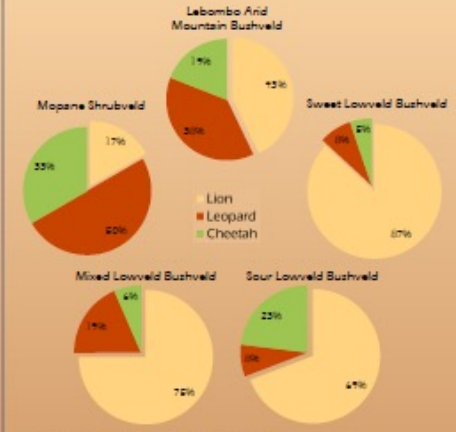


Figure 6: Proportion of cats by vegetation type

Results and Discussion

Upon performing a count of the lions, leopards, and cheetahs in each of the five vegetation types of our study area, I found that the ratio of lions to other cats was highest in Sweet Lowveld Bushveld and Mixed Lowveld Bushveld areas, with 87% lions and 75% lions, respectively. This could mean that leopards and cheetahs harbor a dislike for these vegetation types, but more likely, lions have a preference for those vegetation types. Therefore, these areas would be most suitable for lions when considering expansion of conserved land (Fig. 7).

Upon calculating proximity of cats to bodies of water, I found that cats were sighted on average within 0.27 km of water. This is not a surprise: lions naturally would be found near water to be near a source of hydration and to be near their prey. Also worth mentioning is the fact that our study was conducted during the dry seasons, when most bodies of water were dried up. This would make it even more likely that lions would spend most of their time in areas where water is readily available.

Most cats were found within 3.07 km of water. (Specifically, 3.07 km is the mean distance to water plus one standard deviation.) By making a 3.07 km buffer around rivers and bodies of water, and restricting those areas to vegetation types Sweet Lowveld Bushveld and Mixed Lowveld Bushveld (Fig. 8), you can see what areas around Kruger Park would be good candidates for conservation expansion, as lions have demonstrated a preference for land close to water in Sweet Lowveld Bushveld areas or Mixed Lowveld Bushveld areas.

Given more time and resources, I would expand my study area northward, to include the entirety of Kruger National Park. Our study is spatially limited, and lion conservation efforts would benefit from a larger study area. I would also radio-collar lions, rather than rely on sightings for data collection. This would eliminate the problem caused by the lack of absence data, and allow us to conduct a study that truly only involved lions, rather than having to compare their locations to those of leopards and cheetahs. Additionally, I would begin to look at the land usage for my proposed areas of conservation, to see if any of it is eligible for conversion to conserved land for lions.

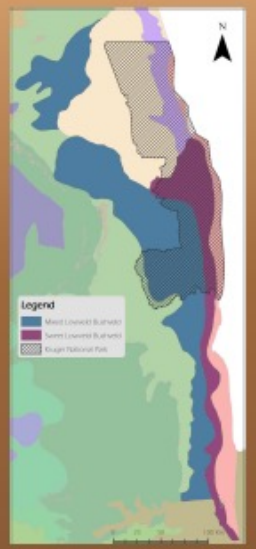


Figure 7: Lions' preferred vegetation types

Figure 8: Priority Conservation Area

Coastal Erosion on Crane Beach, Ipswich MA

Stephanie Berkman
Department of Environmental Conservation

Introduction

Crane Beach is a popular recreation and conservation site in Ipswich Massachusetts. Crane Beach includes over 4 miles of shoreline, 5 miles of trails through the dunes and the North Shore's largest pitch pine forest.

Fig.1: Crane Beach boardwalk

This area has been recognized for its successful shorebird protection program and is a very important nesting site for piping plovers, a threatened bird species. In order to continue protecting the bird species and cater towards the recreational needs of the beach, the size and stability of the shoreline needs to be maintained. This leads me to ask the question: is the Crane Beach coastline eroding?

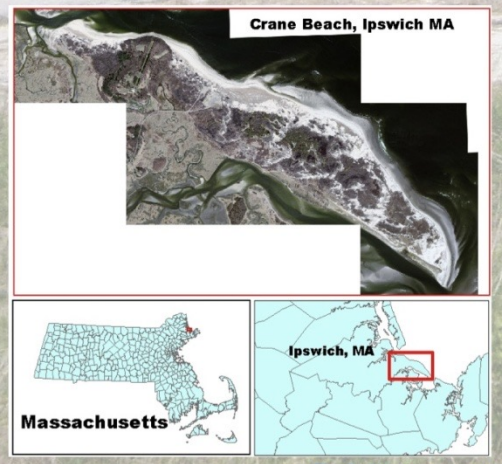


Fig. 2: Study area map

Methods

To conduct my research I acquired all of the orthophotos of the Crane Beach area for the years: 1990, 1994, 2001, 2005 and 2008 as well as a historic coastal topographic map image from 1890 from MassGIS. To answer my research question I followed these steps:

-Created a new line shape file for each year and traced the coastline of that year (taking into consideration differences in tides).

-Compared the coastline of each year with that of 1990 by creating new polygon shape files for areas where coastline increased and decreased since 1990.

- Found the area of the polygons for each year.

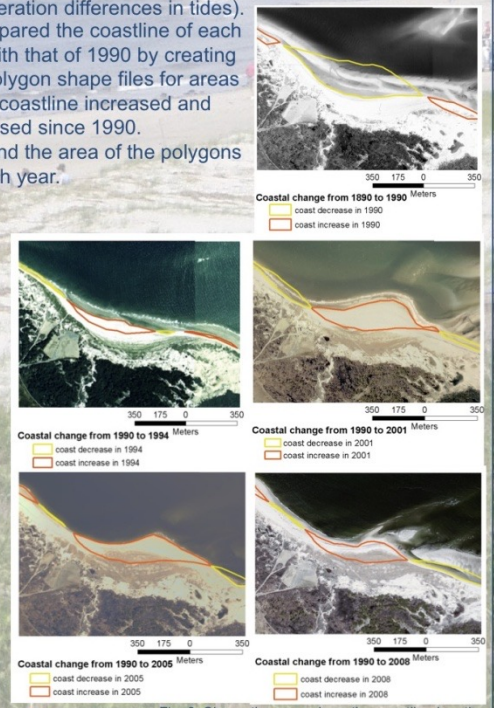


Fig. 3: Shows the area where the coastline has the most variance and different polygons for increased and decreased coast.

Results & Discussion

In doing my research I found that the coastline of Crane Beach is eroding. When comparing the coastline of each year to that of 1990, there is a visible decrease in coast starting in 2001(figure 5). 1994 was the only year that showed an increase in coastline and 2008 showed the most coastline loss. When comparing coastline in 1890 and 1990, a decreased is seen overall as well (figure 6). This large decrease in coastline from 1990 may be of concern to conservationalists of Crane beach.

Fig. 4:Coastline for each year on the 2008 orthophoto

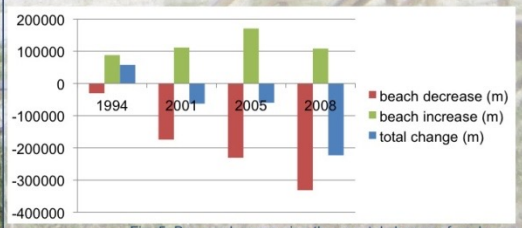


Fig. 5: Bar graph comparing the coastal change of each year

The species that inhabit the beach like the piping plovers need nesting habitat and space for their population to grow.

The increase in tourism to the beach is also putting more pressure on the recreational availability of the site. This yearly decrease in coastline should be taken into consideration while managing the site for recreation as well as conservation, ensuring that the needs of both be met. To track this coastal erosion, yearly coastline measures should be taken to assess if this is a random occurrence due to weather variance through the years, or if the coast is decreasing at a steady rate which would require additional management.

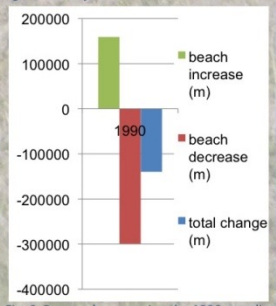
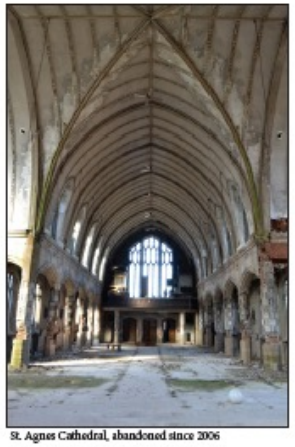


Fig. 6: Bar graph comparing the 1990 coastline change to the 1890 topograph map

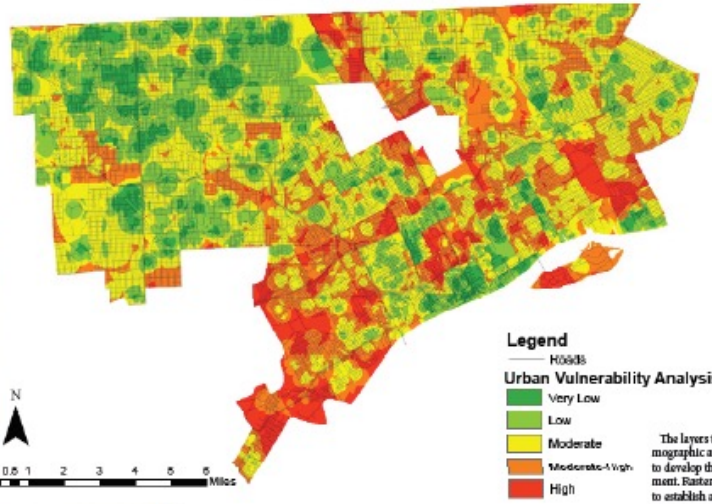
Detroit: A Demographic and Infrastructure Analysis

UMassAmherst

Tyler Osborne Gagné

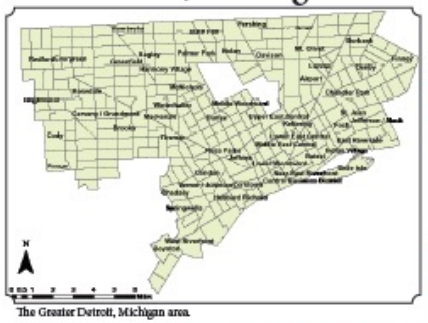


St. Agnes Cathedral, abandoned since 2006

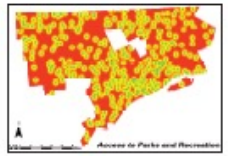


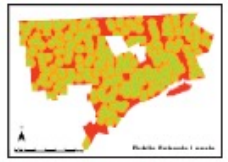
The layers to theright show the demographic and infrastructure files used to develop the vulnerability assessment. Raster calculator was then used to establish a suitability analysis for the Detroit urban area. *Data was collected from the Detroit ITS Department.*

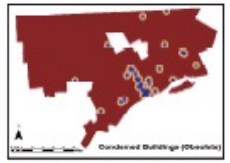
Detroit, Michigan

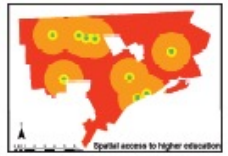


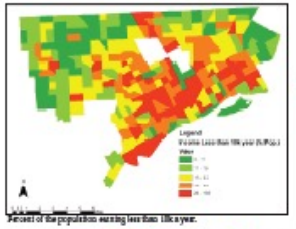
The Greater Detroit, Michigan area.



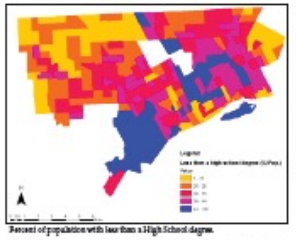








Percent of the population earning less than 10k a year.



Percent of population with less than a High School degree.

The Detroit Boat Club, abandoned since 1996.

Central Michigan Train Station, abandoned since 1988.

Introduction

In January of 2012 several acquaintances and I took a trip to Detroit, Michigan. Our goal was to experience firsthand the decay and fall from grace that Detroit has become so well known for. What we saw was worse then we could have even expected, entire blocks of burned out and abandoned houses, auto factories six blocks long abandoned and gutted, twenty story hotels from the golden age now standing as skeletons, schools, universities, hospitals, zoos, parks, mills, factories and more, all left to wither. Detroit in the past hundred years has experienced more growth and decline than any other US city, from a population in 1910 of 285,000 to a high in 1950 of 1.8 million, to an unmatched decline of over 500,000 to 713,000 in 2010. This project aims to analyze the relationships between demographic factors and infrastructure factors to look for relationships and discrepancies that may be detrimental to the social justice and equity of the city.

Results & Discussion

The outputs that were obtained from the raster calculations showed the hotspots around the city that had varying levels of risk. These various hotspots are areas that the resulting demographic factors such as low levels of high school graduation, and poverty levels may be a result of the infrastructure composition of the area. In order to gain a more accurate understanding of the social equity related to the infrastructure of Detroit, more extensive research should be conducted on the spatial influence of positive and negative factors of a city, crime rates, police station locale effectiveness, public school and higher education proximity influence, and other pressures.

Methods

Data was obtained from the City of Detroit Information Technology Services Department, the data primarily contained shapefiles that consisted of police stations, colleges, parks and recreational sites, condemed buiklings, and census data for education and income per census block. A literature review was conducted on the social-urban equity landscape; to calculate the best methods for classification of spatial vulnerability, relative to distances from the particular variables and data collected. This research permitted the data to to be classified into quantifiable values, which then allowed for raster calculation to be employed to search for connections amoung the particular infrastructure, demographic, and economic data.

Contact:
Tyler Osborne Gagne
TGagne@student.umass.edu
(774) 328.1734

Acknowledgements:
City of Detroit Information Technology Services Department
(313) 224-9427 - Department E-Mail: gis_sales_center@detroitmi.gov
Inspiration: Daniel Peary Madsen, Christopher Hocker, Jakob Pulcher

Yeah, But How Do I Make It?

To…PowerPoint!

Exporting Images

- Always Export when possible, don't use screnshots!
- Higher resolution images look better but take up more hard drive space.
  - This can be an issue inside of PowerPoint sometimes – another reason we print pdfs!
- Do Not Accept the Defaults!

Any Questions?

Thinking Computationally

- "**Computational thinking** is a way of solving problems, designing systems, and understanding human behavior that draws on concepts fundamental to computer science. To flourish in today's world, **computational thinking** has to be a fundamental part of the way people think and understand the world." –Carnegie Mellon University

Train Your Brain

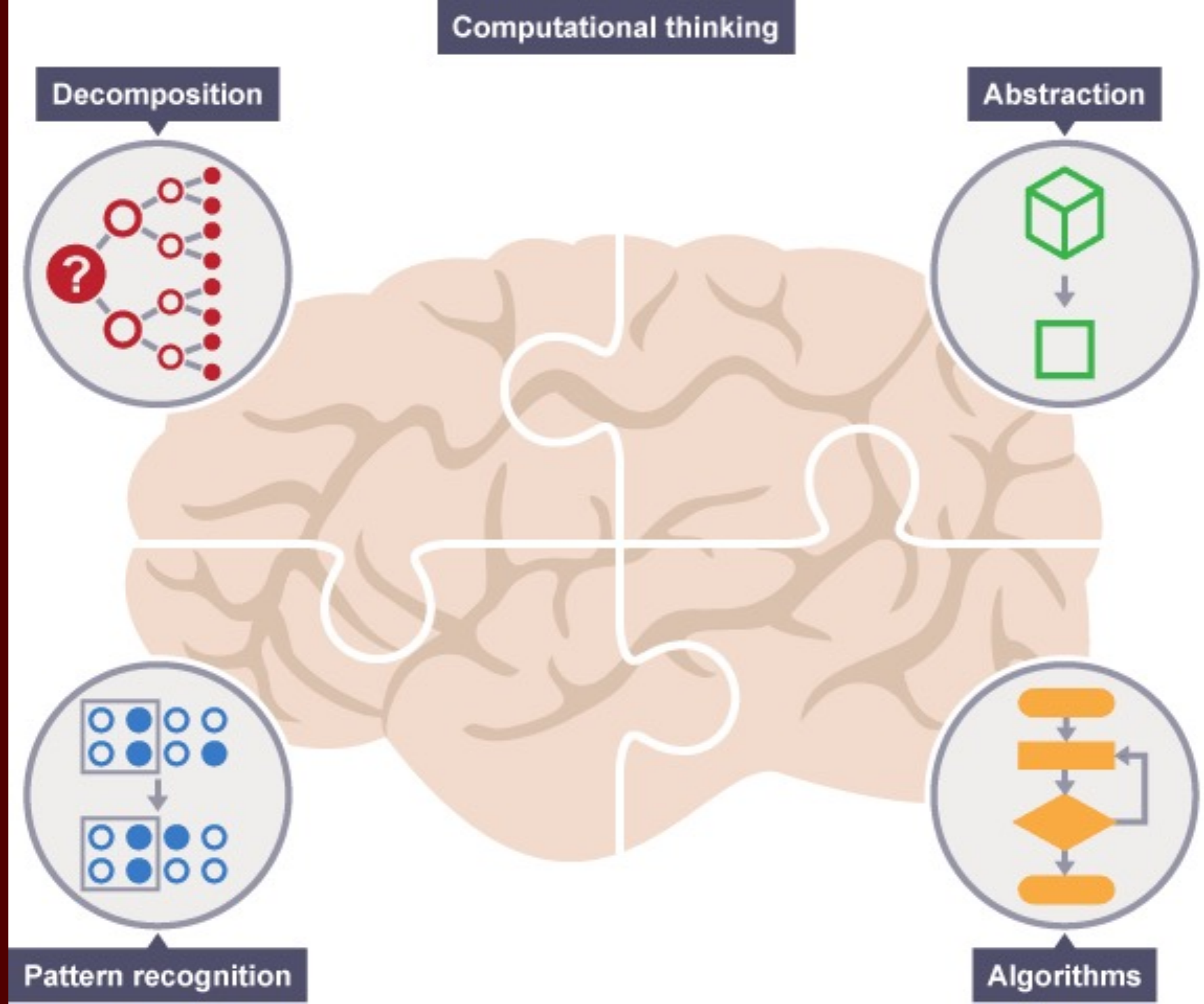
https://www.youtube.com/watch?v=SVVB5RQfYxk

Sound Familiar?

- Gathering and analyzing data;
- Using models and tools in various ways;
- Creating solutions to represent or solve real world problems.

Hmmmmmmmmmmmmmm

Tx.ag/GIS11



http://www.bbc.co.uk/education/topics/z7tp34j

Decomposition

- Involves breaking down a complex problem or system into smaller parts that are more manageable and easier to understand.

- A natural problem solving activity.

Try It! - Decomposition

- Problem: Houston has incredible issues with urban flooding*. How can we use GIS to help?

http://www.cbsnews.com/news/houston-mayor-says-theres-no-solution-to-flooding-there/

Filling in the blanks - Decomposition

Pattern Recognition

- Involves finding the similarities or patterns among small, decomposed problems that can help us solve more complex problems more efficiently.

What are patterns?

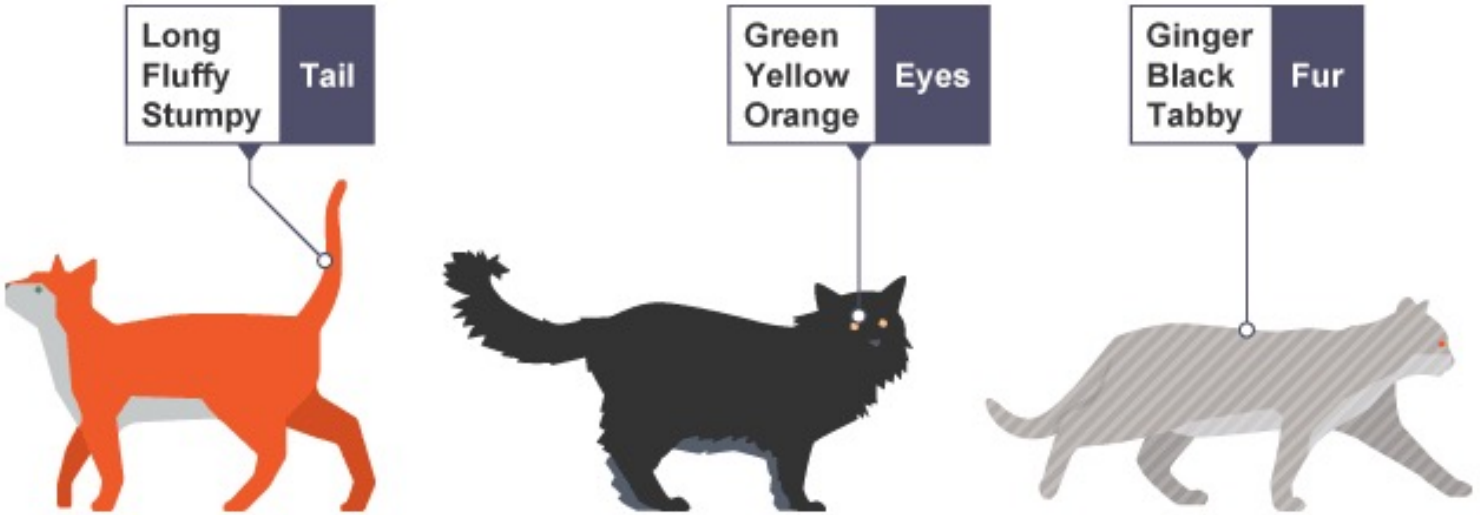
Imagine that we want to draw a series of cats.

All cats share common characteristics. Among other things **they all have eyes, tails and fur**. They also like to eat fish and make meowing sounds.

Because we know that all cats have eyes, tails and fur, we can make a good attempt at drawing a cat, simply by including these common characteristics.

In **computational thinking**, these characteristics are known as patterns. **Once we know how to describe one cat we can describe others, simply by following this pattern.** The only things that are different are the specifics:

- one cat may have green **eyes**, a long **tail** and black **fur**
- another cat may have yellow **eyes**, a short **tail** and striped **fur**



Power of Patterns

- Identifying patterns allows us to understand common features and apply common processes.

- Patterns exist among different problems and within individual problems. We need to look for both.

Try It! - Patterns

- Problem: ~~Houston~~ Colorado has incredible issues with ~~urban~~ flash flooding. How can we use GIS to help?

- https://nextcity.org/features/view/you-cant-stop-urban-flooding

Filling in the blanks - Patterns

Abstraction

- The process of filtering out – ignoring - the characteristics of patterns that we don't need in order to concentrate on those that we do.
- It is also the filtering out of specific details. From this we create a representation (idea) of what we are trying to solve.

Reducing Complexity

- Abstraction gathers the general characteristics we need and filters out the details and characteristics that we do not need.

- Abstraction lets us overcome issues with specifics by outlining general processes.

General patterns	Specific details
We need to know that a cake has ingredients	We don't need to know what those ingredients are
We need to know that each ingredient has a specified quantity	We don't need to know what that quantity is
We need to know that each cake needs a specified time to bake	We don't need to know how long the time is

Try It!

- Problem: ~~Houston Colorado~~ People are impacted ~~has incredible issues with urban~~ by ~~flash~~ flooding. How can we use GIS to help?

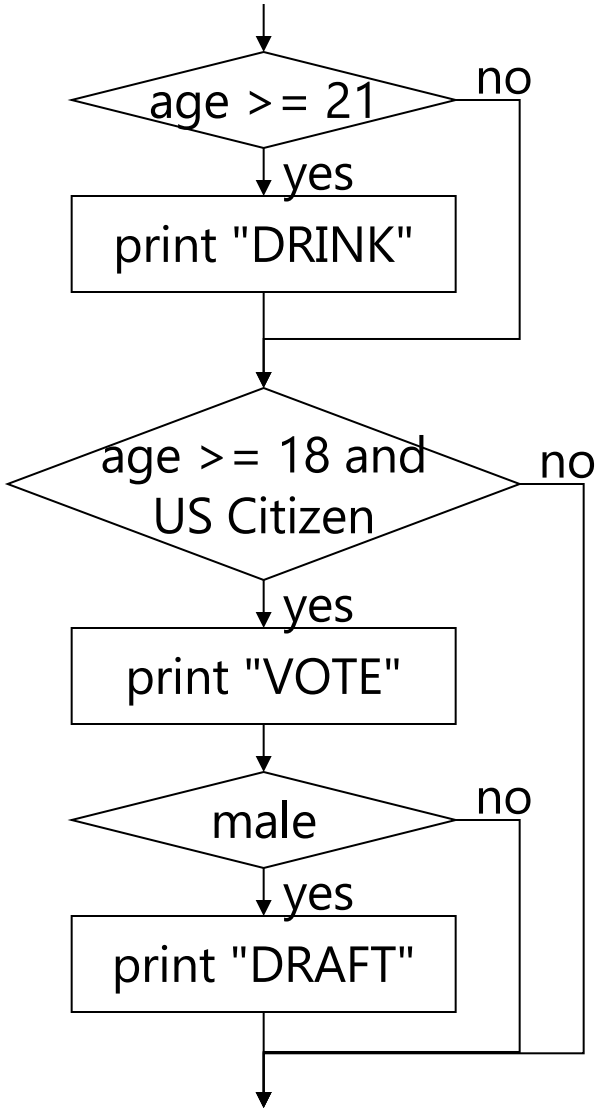
Filling in the blanks

Algorithms

- An algorithm is a plan, a set of step-by-step instructions to solve a problem.

- Algorithms are used for many different things including calculations, data processing and automation.

Making the Difficult Step



Last Practice

age	US Citizen	male	printed
			<nothing>
			DRINK
			VOTE
			DRAFT
			DRINK, VOTE
			DRINK DRAFT
			VOTE, DRAFT
			DRINK, VOTE, DRAFT

Resources

- https://computationalthinkingcourse.withgoogle.com/course?use_last_location=true
- https://www.edx.org/course/introduction-computational-thinking-data-mitx-6-00-2x-3
- https://www.coursera.org/learn/algorithmic-thinking-1/?source=phoenixCdp2016AbTest

Kahoot.it!

https://play.kahoot.it/#/k/c867bdcc-9da8-4caf-b658-dd45eef0c5ad

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