

# CS 51 Computer Science Principles

## APCSP Module 3: Data, Internet, Computer and Programming

### Unit 5: Global Impacts



LECTURE 7 GLOBAL IMPACTS

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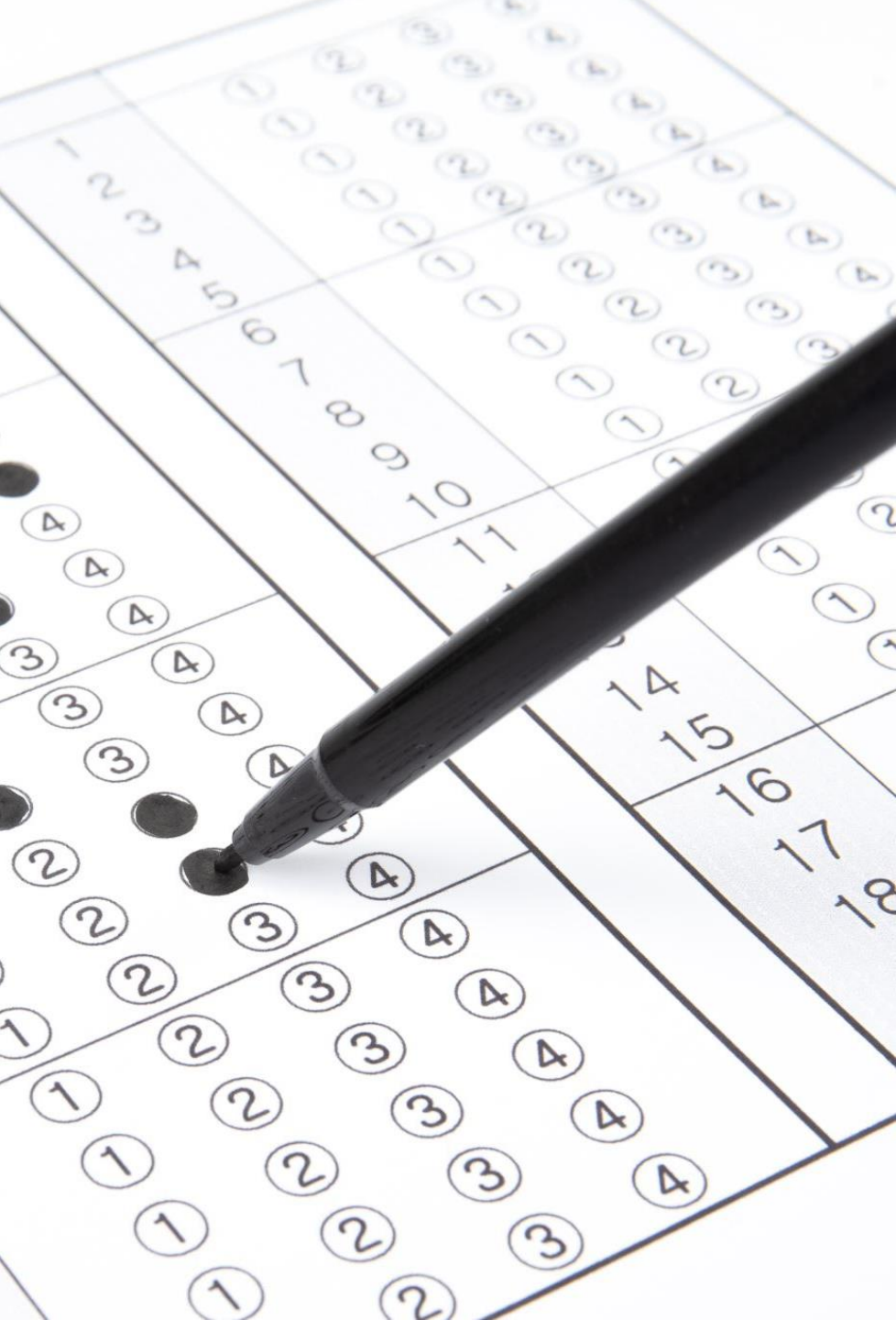
IEEE SENIOR MEMBER



# Objectives

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- This big idea covers all the ways society is impacted by computing devices and how we can help mitigate some of the harmful effects.



# Unit Overview

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## Exam Weighing:

- 11-15% of the AP Exam
- Practically, this translates to about 10 questions on the test.



# Overview

LECTURE 1

# Vocabulary

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- Beneficial and Harmful Effects
- Netizenship
- Network Neutrality
- Internet Engineering Task Force
- Crowdsourcing
- Computing Bias
- Digital Divide
- Censorship
- Data Privacy
- Legal and Ethical Concerns
- Intellectual Property



# Beneficial and Harmful Effects

LECTURE 2

# Beneficial and Harmful Effects

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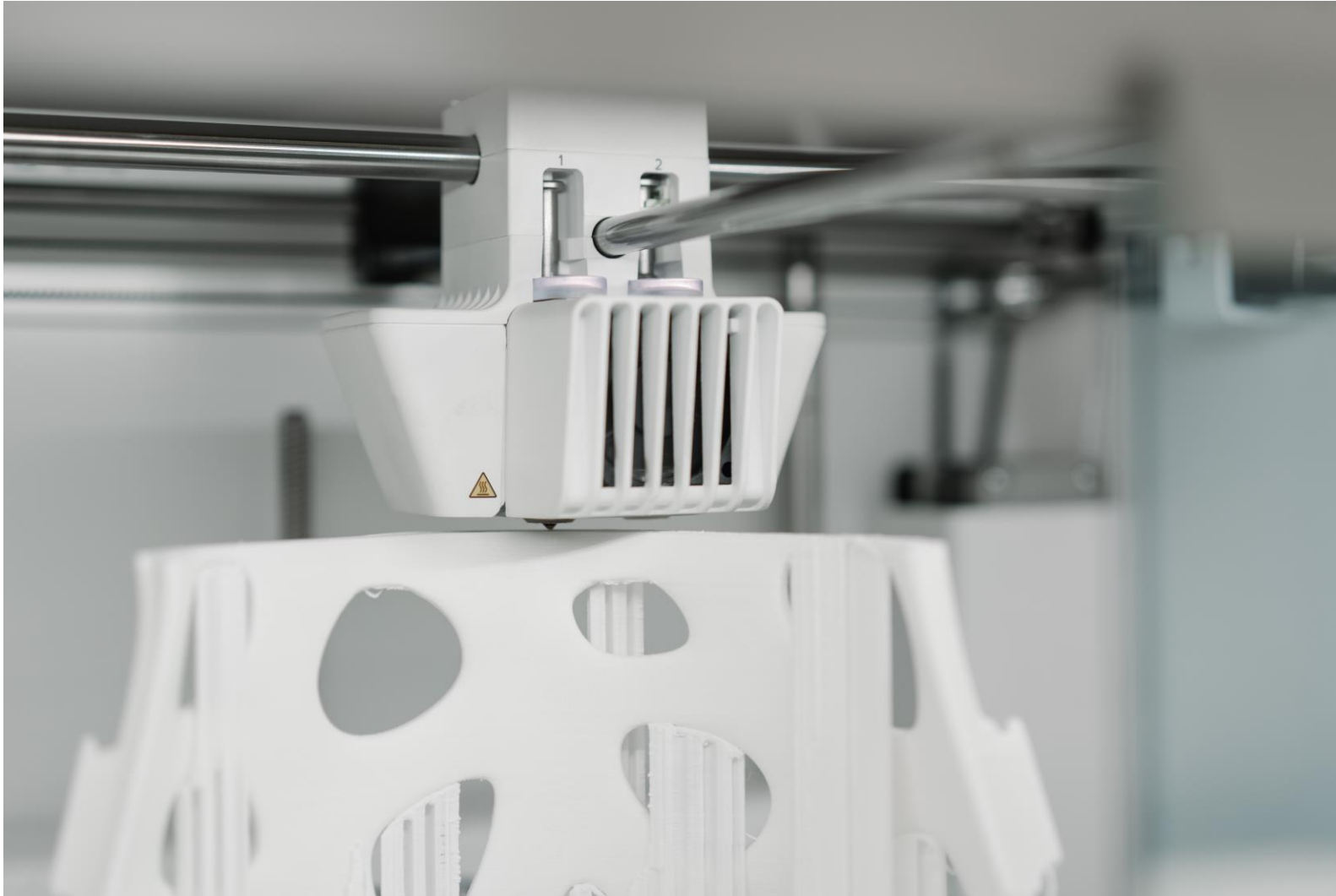
- Think about the activities that make up day-to-day life: going to school, shopping, working, eating, and so on. Increasingly, computing innovations have come to play a role in more and more of these activities.
- As new innovations come out, people will change how they go about their day-to-day business to take advantage of the new technology, which will lead to new societal trends and even more new technology to take advantage of them...

# Beneficial and Harmful Effects

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- Computing innovations have fostered progress and creativity in many ways. Machines have vastly improved the medical field, saving countless lives. Engineers take advantage of computing innovations to collect data and design products.
- Communications have especially flourished; today, we can communicate instantaneously with people anywhere around the world. Even the artistic world has benefited from new ways to create, share, and sell creative works.





A new computing innovation with the potential to aid both the medical and engineering fields is 3D printing. In the image above, a 3D printer is used to make a hand brace.

# Beneficial and Harmful Effects

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- However, computing innovations have both their good sides and their not-so-good sides. (Anyone who's been scrolling Instagram at three in the morning on a school night can attest to that!)
- Not every side or effect of a computing innovation is known in advance, either.
- Innovations take on a life of their own after they're created.

# Consider the following:

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- The World Wide Web was invented in 1989 as a way for the scientific community to share information in a faster and easier way, and has since evolved greatly.
- Targeted advertising is intended to help businesses turn a profit, but it incentivizes the collection of private information and has the potential to be abused.
- Machine learning and data mining have greatly benefitted many fields, but their findings are also susceptible to biases and may unintentionally contribute to discrimination.

# Beneficial and Harmful Effects

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- Computing innovations can be used to both help and to hurt people. Identity theft, cyber-bullying... the list goes on.
- Responsible programmers try to look at the big picture when it comes to the computing innovations they create. They try to catch potential channels for abuse or harm before they can be exploited.

# Beneficial and Harmful Effects

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- However, although they do their best, at the end of the day it's just not possible for programmers to predict all the ways that a computing innovation could be used. There are too many possibilities and external variables involved, especially when the innovation covers a large scale. (Hence why Black Mirror exists.)
- It's important to note that the effects of a computing innovation are up for debate. People can have widely differing opinions on these effects—some people might think they're good, some people might think they're bad. It's also important to mention that there have been unintended positive effects of computing innovations as well. They've led to surprising advances in many fields.



# Netizenship

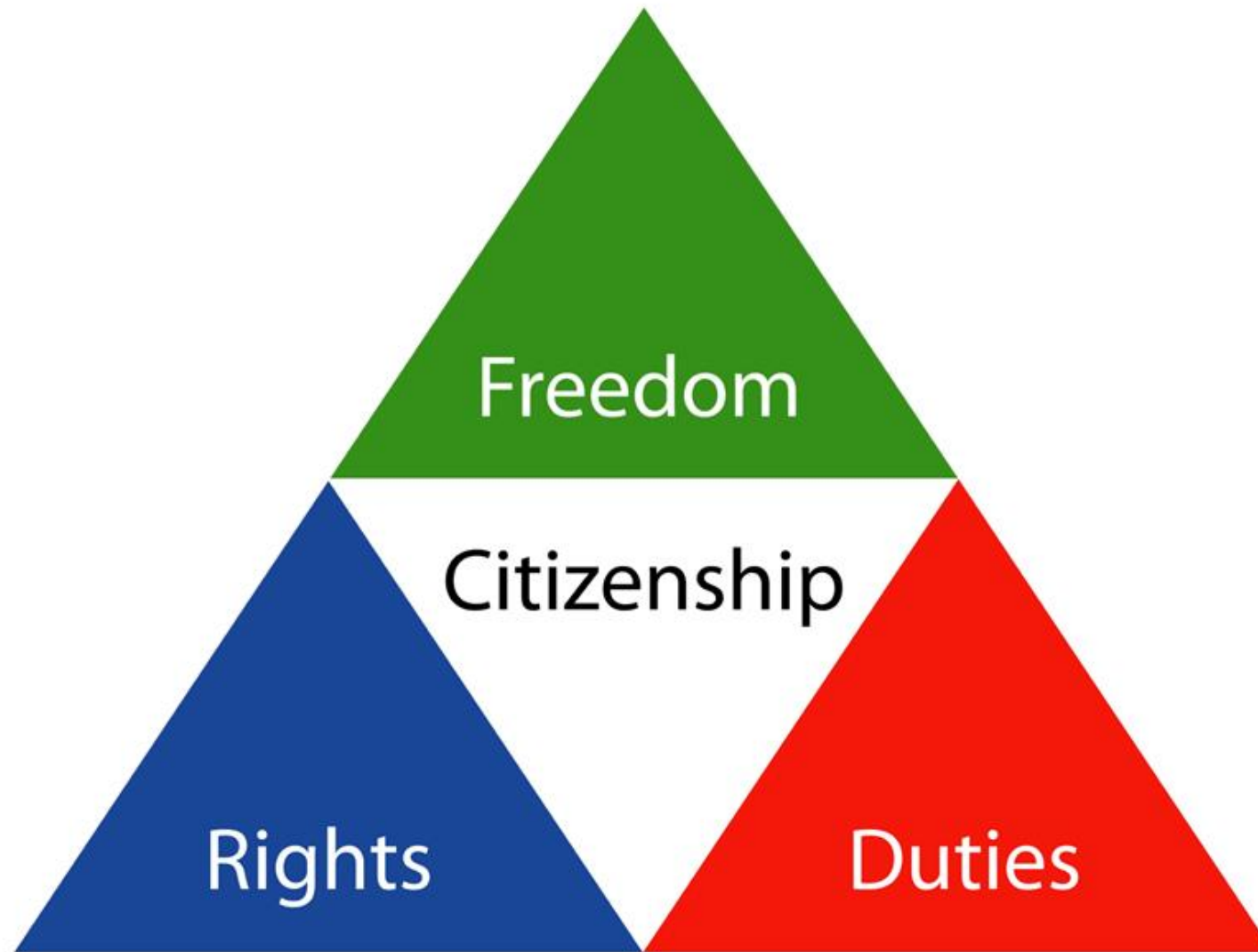
LECTURE 3

# Internet Citizenship

## Participate and Contribute

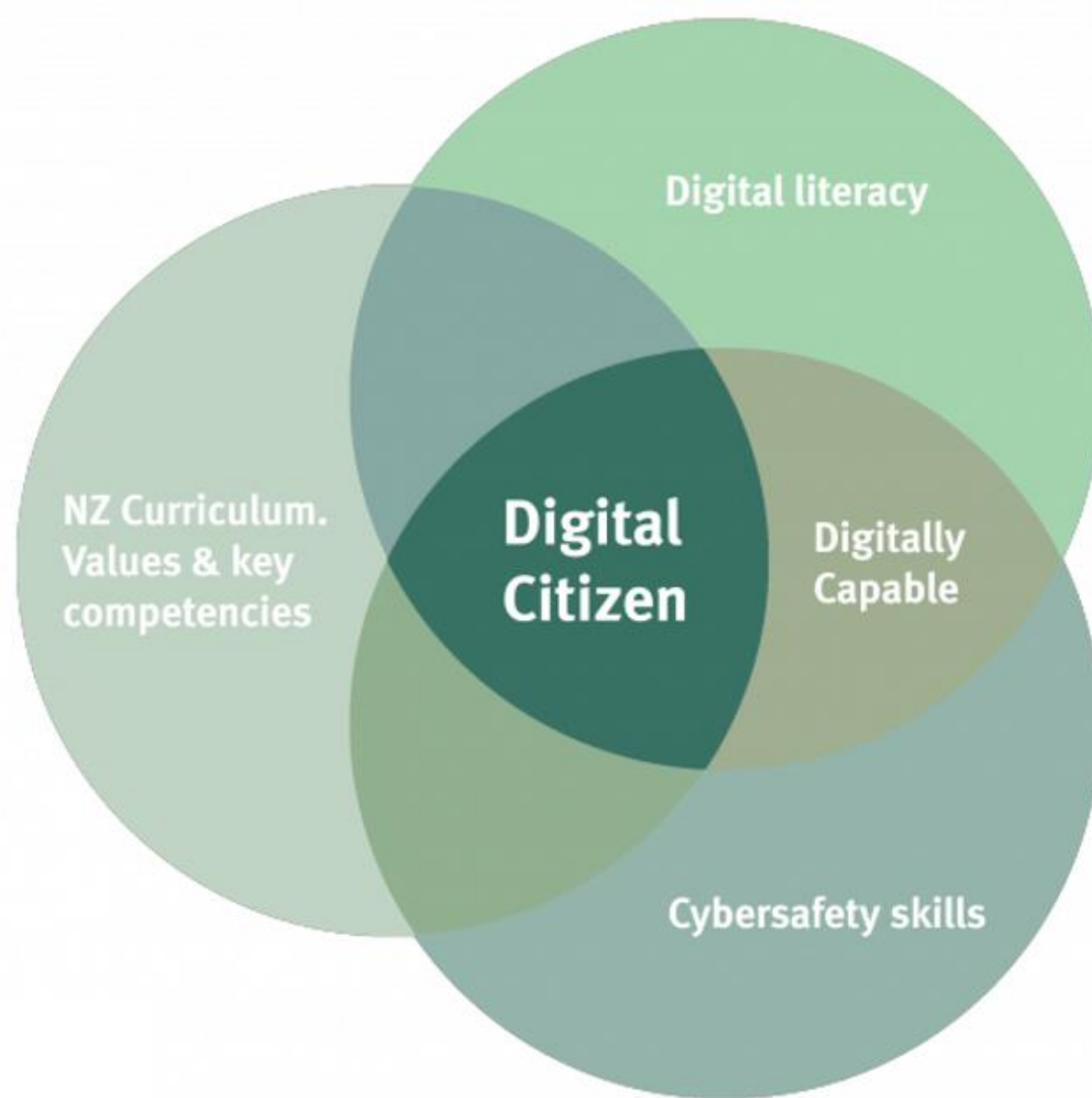
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- It is both interesting and important to know that the protocols or rules by which Internet traffic is governed are not owned or controlled by any **government** or **business** (at the moment).
- It's a group of well-meaning **citizen-engineers** dedicated to keeping the Internet free, open and robust for all.











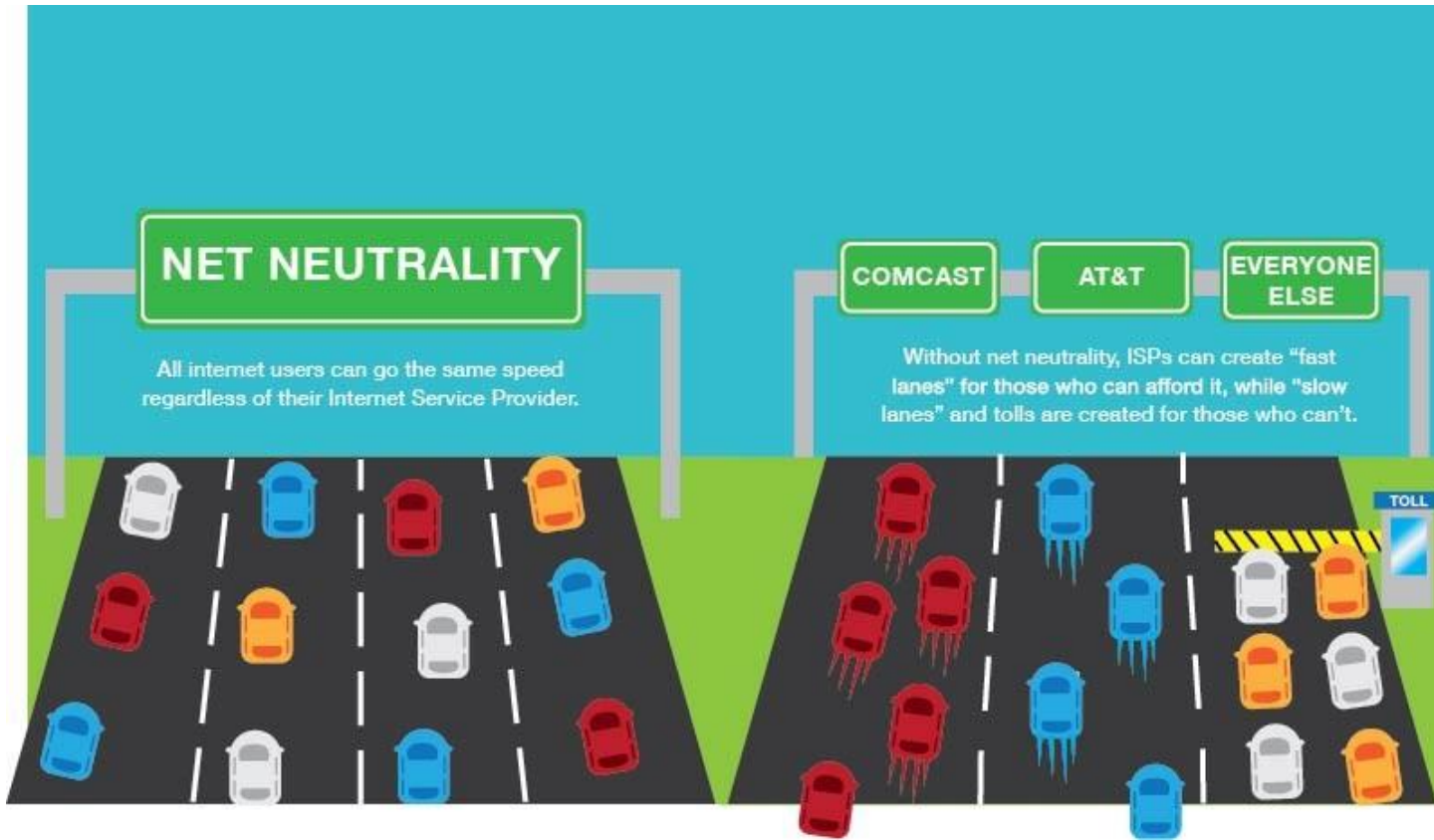
# Network Neutrality

LECTURE 4

**THIS COULD BE THE INTERNET  
WITHOUT NET NEUTRALITY.**

<b>PACK 1</b> \$5 MONTH  GET ACCESS TO: 	<b>PACK 2</b> \$10 MONTH  GET ACCESS TO: 	<b>PACK 3</b> \$15 MONTH  GET ACCESS TO: 
<b>PACK 4</b> \$20 MONTH  GET ACCESS TO: 	<b>PACK 5</b> \$30 MONTH  GET ACCESS TO: 	<b>UNLIMITED</b> \$100 MONTH  GET ACCESS TO EVERYTHING

# Neutrality: Free Access



Neutrality:  
Equal  
Opportunity



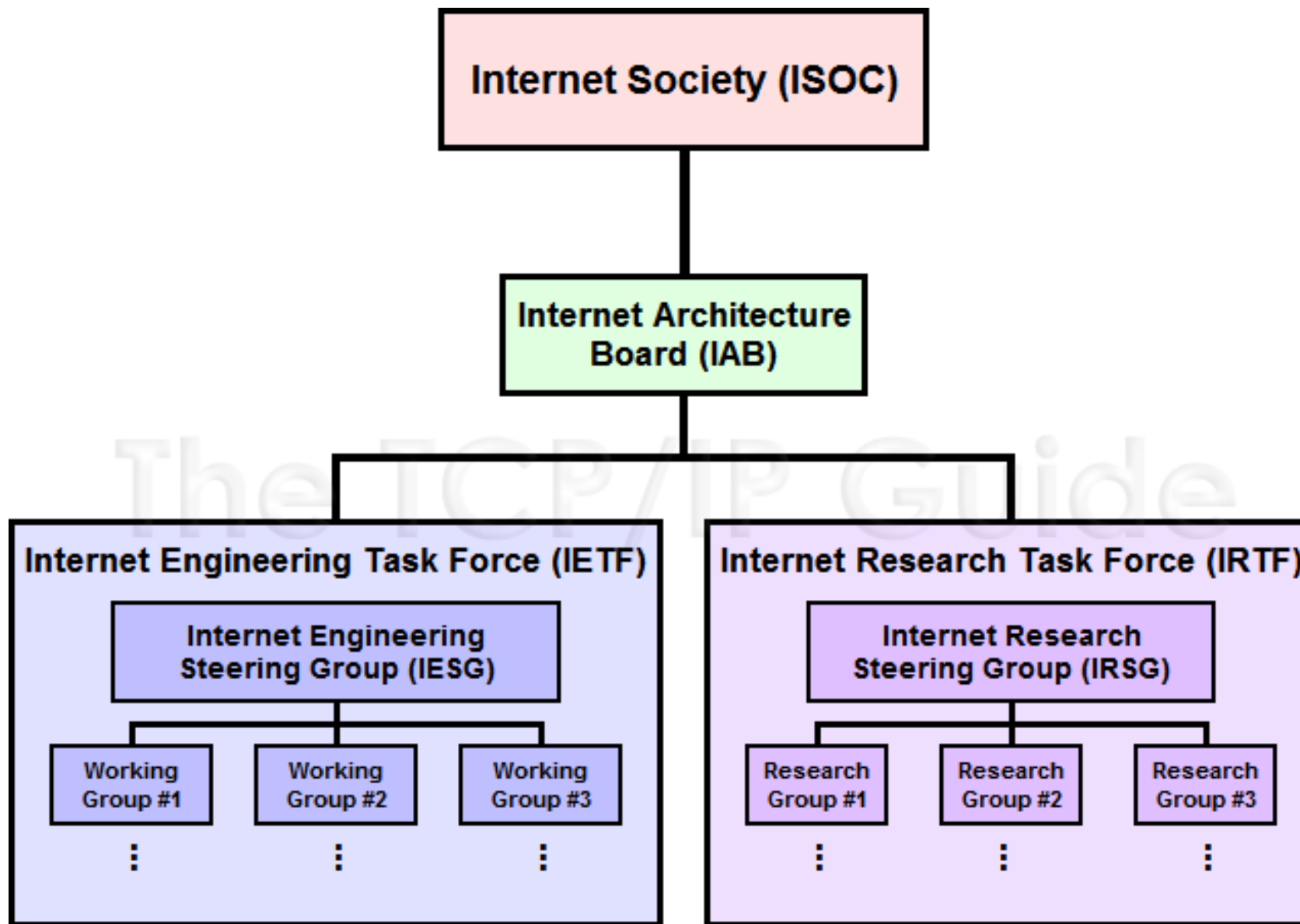
# The Internet Engineering Task Force

LECTURE 5

# The Internet Engineering Task Force (IETF)

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- The Internet Engineering Task Force (**IETF**) is the group of mostly volunteer citizens that proposes and develops all of the standards and protocols that exist on the Internet.
- Request for Comments (**RFC**) documents - like the one we use in the lesson - are how these standards and protocols are defined and published for all to see on the IETF website. They are some of the best-written technical documents in existence.







# Who Developed Protocols?

- So who develops these protocols? Who makes the final decisions? Who is in charge? The amazing thing is that no single person, government, or corporation is in charge.
- The Internet is a collection of citizens and volunteers interested in defining the standards who formed a volunteer organization called the Internet Engineering Task Force to develop and promote voluntary internet standards IETF.

The image is a composite graphic. The top half shows a view of Earth from space, with the continents of North America, South America, and Africa visible against a blue sky with some clouds. The bottom half shows a dark, curved surface, possibly representing the Earth at night or a satellite view, covered with a dense, glowing network of white lines and yellow nodes, symbolizing a global network or the Internet. The text "Internet is for Everyone" is centered over the image in a blue, sans-serif font.

# Internet is for Everyone



# Crowdsourcing

LECTURE 6

# Crowdsourcing

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- The rise of the internet has led to a rise in the amount of data and human capital available to researchers. This free flow of data and information makes identifying and solving problems easier, and more people have access to the solution once it's found. Think about all the problems you've been able to solve with a quick Google Search, where before you'd have to consult a manual or a professional.
- The spirit of collaboration the internet can foster (on a good day) extends to larger, more formal systems as well. Two examples are known as Citizen Science and Crowdsourcing.



# Citizen Science

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**Citizen science** is a term that describes scientific research that the common population helps to conduct. Ordinary citizens help contribute data to research projects using computing devices. They might, for example, count birds they see at local feeders or observe the sky to find new galaxies. Citizen science gives a wide range of people the ability to contribute to scientific studies and, in turn, provides more diverse data for scientists to work with.

# Examples of Citizen Science

Name	Description	URL
Christmas Birds	Every winter, the Audubon Bird Society hosts the Christmas Bird Count, where volunteers go out and count birds. The data is then used to help measure the health of bird populations.	<a href="https://www.audubon.org/conservation/science/christmas-bird-count">https://www.audubon.org/conservation/science/christmas-bird-count</a>
eBird	eBird is an online database of bird information that birdwatchers help to collect. It is among one of the world's largest "biodiversity-related science projects," with more than 100 million bird sightings contributed per year.	<a href="https://ebird.org/home">https://ebird.org/home</a>
Zooniverse	The largest platform for citizen science, Zooniverse hosts over 50 projects in a wide range of fields, from the arts to astronomy.	<a href="https://www.zooniverse.org/">https://www.zooniverse.org/</a>

# Examples of Citizen Science

Name	Description	URL
Nasa	Nasa hosts several citizen science projects, from tracking penguin colonies to studying giant kelp forests.	<a href="https://science.nasa.gov/citizen-science">https://science.nasa.gov/citizen-science</a>
National Geographic	National Geographic also lists a wide range of citizen science projects, mainly in the fields of biology and earth science.	<a href="https://www.nationalgeographic.org/topics/citizen-science/?q=&amp;page=1&amp;per_page=25">https://www.nationalgeographic.org/topics/citizen-science/?q=&amp;page=1&amp;per_page=25</a>

# Crowdsourcing

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- **Crowdsourcing** is the practice of getting a large amount of input or information from people on the Internet. Citizen science is an example of crowdsourcing, but crowdsourcing can also take other forms. Companies can turn to the "crowd," or the general public, for feedback (like those College Board surveys you get in the mail). They can crowdsource for employment. Uber and Airbnb, for example, crowdsource their labor force of drivers and renters. They can also crowdsource to solve problems or to get content.
- Crowdsourcing can also take the form of financial support in a process known as **crowdfunding**. Crowdfunding sites like GoFundMe, Kickstarter, and Patreon allow people to raise money for all manner of causes, from creating works of art to (unfortunately) funding medical bills.





# Computing Bias

LECTURE 7

# Computing Bias

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As we've discussed throughout these guides, computing innovations can reflect existing biases. **Biases** can be embedded at all levels of development, from the brainstorming phase to the work done after release. This can take the form of a bias written into the algorithm itself or bias in the data used.

# Computing Bias

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- For example, criminal risk assessment tools are used to determine the chances that a defendant will re-offend, or commit another crime. This information is then used to influence decisions across the judicial process.
- However, these algorithms are trained to pick out patterns and make decisions based on historical data, and historical data is historically biased against certain **races** and **classes**. As a result, risk assessment tools may disproportionately flag certain groups as risks.

# Computing Bias

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- Algorithms might also be trained on sets of data that aren't as diverse as they need to be. For example, facial recognition systems are often trained on data sets that contain fewer images of women and minorities than men in the majority.
- Finally, computing innovations use data from the world around them, and that world is often biased in its own right.

# Computing Bias

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- People can take steps to combat these biases. They can be mindful of the potential for bias and make sure that their data is as unbiased and representative as possible.
- This is not only good for the program itself, but also for society as a whole. After all, algorithms are written by people, and being able to find and eliminate bias in computers can help us eliminate bias in ourselves as well.



# Digital Divide

LECTURE 8

# Digital Divide

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The **digital divide** refers to the gaps between those who have easy access to the internet and technology and those who don't. Internet and technology access varies across several factors:

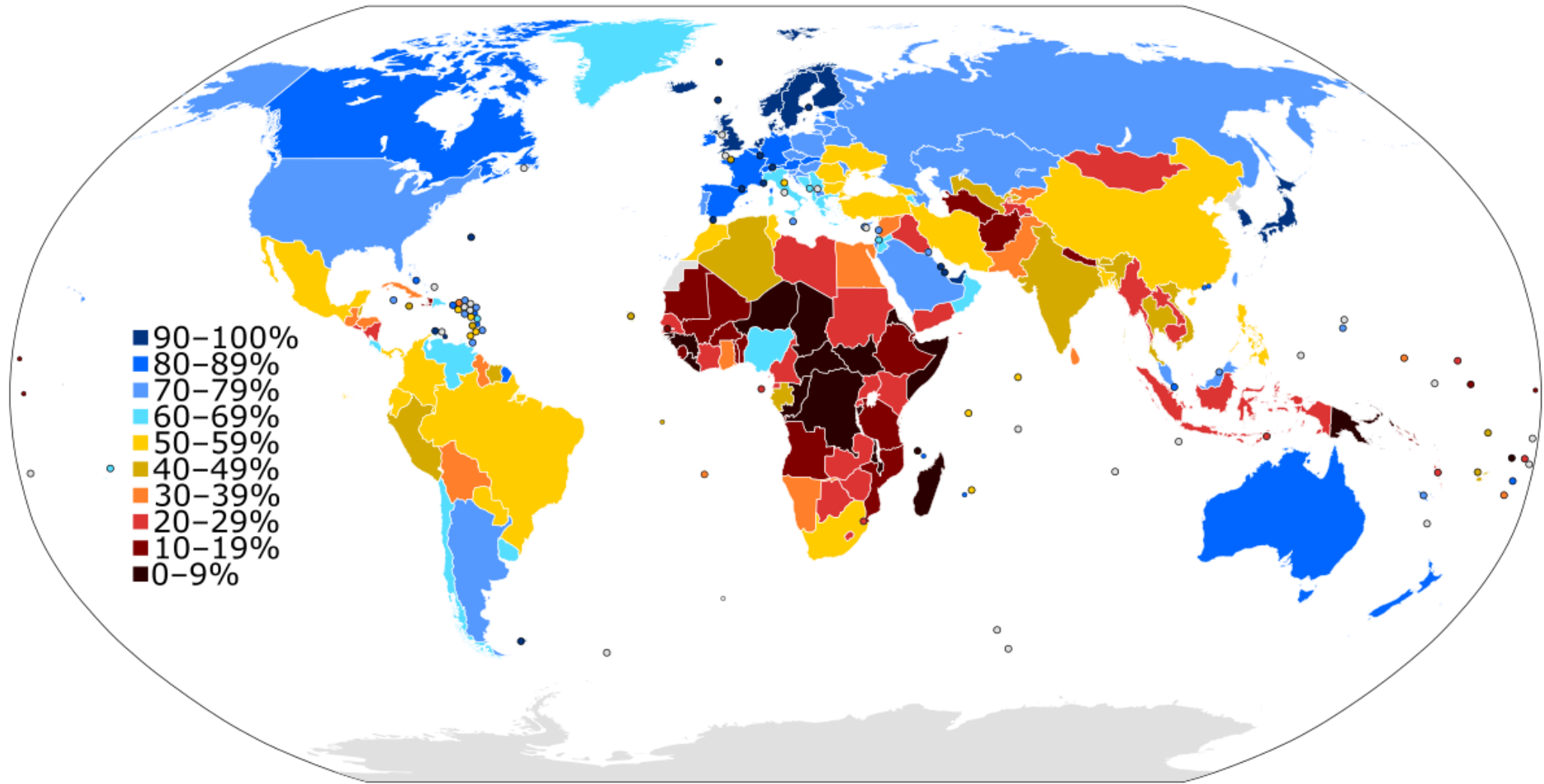
- **Demographic** (Younger people are more likely to be comfortable with the internet than older people, people with higher levels of education tend to use the internet more than people with lower levels of education)
- **Socioeconomic** (People with higher incomes are more likely to have quality access to digital tools than people with lower incomes)
- **Geographic** (some areas allow for more internet access than others, some areas are easier to connect to the internet than others)

# Digital Divide

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- The digital divide is both an *intra-national* and *international* issue: it occurs both within countries and between countries. For example, countries in the Western world tend to have a larger percentage of internet users than those outside of it. However, there are also digital divides within countries.
- Take, for example, the United States, where reportedly 21 million Americans lack access to reliable, high-speed internet.





This graphic shows the number of internet users in each country as a percentage of their total population.

# Digital Divide

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- With the internet becoming such an important part of our lives, those without access to technology and the internet are also denied access to crucial resources. Lack of internet access leads to less efficient businesses and educational systems, for example, because those businesses can't communicate as quickly as their competitors and those students are denied access to assignments and learning resources.
- This divide can also exacerbate already present inequalities: between rich and poor, between certain races, between (well-connected) urban and (not well connected) rural communities. The digital divide reflects and raises issues of equity, access and influence, both globally and locally.

# Digital Divide

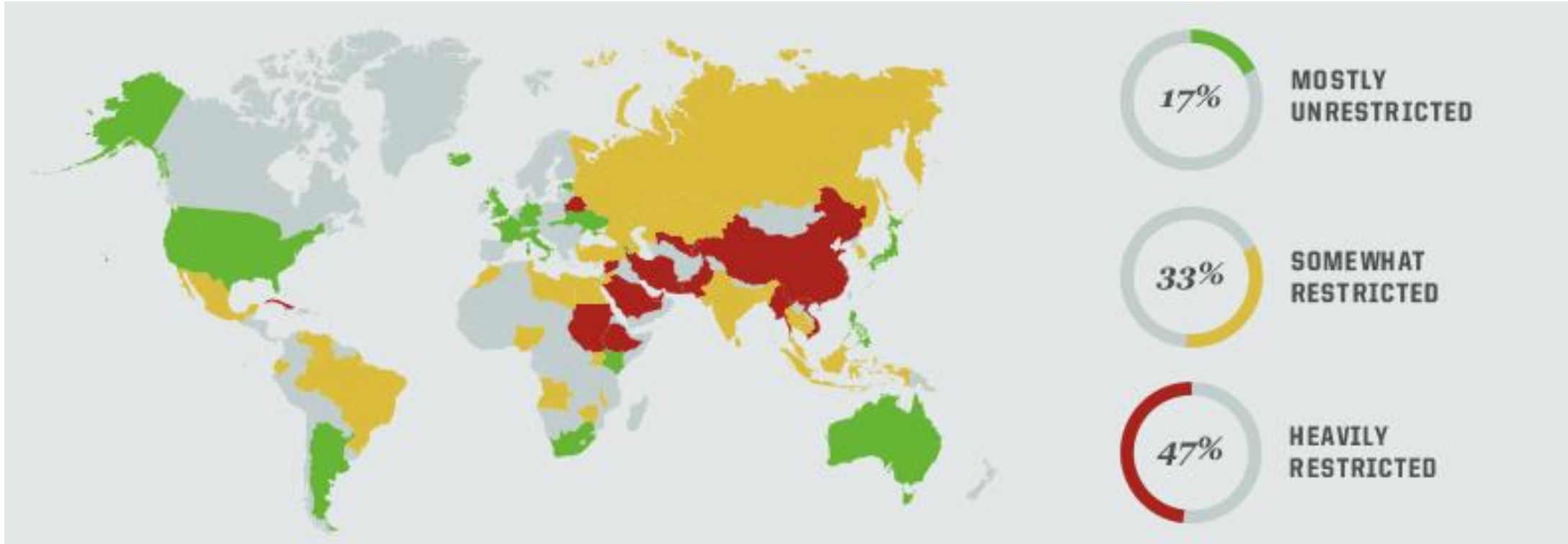
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- Fortunately, there are steps that people can take to help reduce the digital divide. Here are some examples!
- Schools with the funding and resources can provide devices and/or hotspots to students that need them.
- Local and national governments can fund businesses that provide internet access to areas that don't currently have access.
- Governments and individuals can also help support institutions that provide communal internet access, such as libraries.
- Websites and governments can release educational resources to help newcomers navigate the internet.



# Censorship

LECTURE 9



# Countries which Enforces Internet Censorship

# Internet Censorship

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Fake News

Mind  
Control

Spying

Censorship

# Objectives

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- Legal and Ethical Concerns
  - Intellectual Properties (Copyrights, Trademarks, Patents)
  - Other Issues
- Safe Computing
  - Issues
  - Authentication
  - Encryption
  - Additional Measures for Safe Computing



# Legal and Ethical Concerns

LECTURE 10



# Legal and Ethical Concerns

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- The Internet gives people easy, quick, widely-distributed, and free access to a lot of other people and a lot of content. Naturally, this raises legal and ethical concerns. One of the key areas where concerns are raised is in the world of intellectual property, where content creators have to contend with challenges to their rights to own, sell and use their works.
- Protecting intellectual property, at its best, helps foster innovation and guarantees that people reap the rewards of their hard work.
- One of the ways intellectual property is protected is through copyright.

# Copyrights

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- **Copyright** is the right that the creator of a work has to determine who gets to use it. It's not a new concept: copyright laws have been around since the 18th century. However, the digital age has created new challenges to copyright and demands new ways to protect it as well.

 Check out [this primer](#) on copyright!

- Before you use or repost content from the internet, you have to consider *what* the copyright on it is. Just because a piece of art or an image can be easily found on the internet doesn't mean that it's free to use, and especially not if you're turning a profit.

# Copyrights

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- Material created on a computer, be it an image, a piece of digital art, or a piece of writing, is the intellectual property of the creator who made it (or of the organization that owns the intellectual property rights.)
- Using content created by someone else without permission can have consequences, such as a fine or an order to remove the copyrighted content. If you were to claim that the content you borrowed was your own, even unintentionally, you might be found guilty of plagiarism.

# Copyrights

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- It's not difficult in the age of image searches and [Turnitin.com](https://www.turnitin.com) to be caught using copyrighted or plagiarized material. It can also be disheartening for content creators to see their hard work taken without permission or credit, especially if they're trying to grow their presence online.
- As a good practice, you should cite any material you use that you didn't create.
- So, what's an aspiring slide-show creator or aesthetic post maker to do? Fortunately, the internet offers free material for people to use.

# Copyrights

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- **Creative Commons** is a public copyright license that a creator uses when they want to give others the right to use their work. Many Wikipedia images, for example, fall under a Creative Commons license. Creative Commons provides six levels of licensing that you can read about [here](#)!
- **Open-sourcing**, as briefly discussed in Big Idea 1, allows for work to be freely shared, distributed, and modified. Open source is usually mentioned in the context of software.
- **Open access**, on the other hand, refers to research available to the general public that's free of many restrictions. For example, some academic journals are open access or have open access sections.



# Other Legal and Ethical Concerns

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As with anything else, the potential to hurt people that computing devices provide raises concerns. A lot of concerns, as a matter of fact. Here are just a few examples:

- Streaming software allows you to watch your favorite movies and TV shows anytime, anywhere. Illegal streaming software, on the other hand, can violate copyright law and deprive creators of much-needed revenue.
- Biased algorithms can misrepresent or exclude people, as seen above.
- Some computing devices collect and analyze data through continuous monitoring of user activities. An example would be a step-tracker or screen-time tracker on your phone. This raises concerns about privacy and data use.
- The digital divide itself also raises ethical concerns, for reasons covered above.

# Other Legal and Ethical Concerns

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Computing devices also play a massive role in society and politics, and not always for the better.

- The internet can be used to spread misinformation that could be harmful to people's health and well-being.
- Algorithms designed to keep people scrolling on social media websites can create echo chambers, contributing to political polarization.
- Recently, there's also been debate about the role that internet platforms should play in fostering free speech.

The digital age is still very new, and we'll run into more legal and ethical issues the more we navigate it.

 [Ethical Use of the Computer: AP Central](#)





# Data Privacy

LECTURE 11



# Research Yourself

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ACTIVITY

# Data Breaches

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- Look at the [World's Biggest Data Breaches Visualization - Web Site](#) (link in code studio)
- What kind of data is being lost? And how much? What kinds of issues could arise from this data getting into the wrong hands?

# Data Privacy Lab

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- Look at the Data Privacy Lab - Web Site (10 min)
- Type in your information (birthday, ZIP code, and gender) to determine how many other people share those characteristics.

# Research Yourself

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- While there are many potential benefits associated with the collection and analysis of large amounts of data, these advances pose a constant risk to our collective security and privacy.
- **Large-scale data breaches** mean that the details of our personal, professional, and financial lives may be at risk.
- To prevent personal data from being linked to an individual person, personally identifying information, such as name, address, or identification number, is often removed from publicly available data.

# Research Yourself

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- Nevertheless, through the use of computational analysis, it is often possible to “re-identify” individuals within data, based on seemingly innocuous information.
- As more of our lives is digitized, questions of security and privacy become ever more prevalent.

digitalYOU

# Activity Guide - Research Yourself

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## **Your Digital Self**

You may already be aware of information about you that is freely available online, but you probably haven't thought about it from the standpoint of research. Suppose someone were to research you online. What would they be able to find? What connections could they make from the existing data out there to learn even more about you?



# Activity Guide - Research Yourself

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## **Conducting Your Research**

You should look through any publicly available pieces of information online. Start by simply looking up your name in a search engine but then refine your results by adding more specific information, like the place you live. Don't forget social networks, your school website, or any other websites you frequently use.

# Activity Guide - Research Yourself

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## Record Your Findings

In the space below record the information you find about yourself. If you know something is available online but can't get to it now, record it anyway. If you need more space, you can record your findings on the back of this sheet as well.

Information	Where you found it

# Activity Guide - Research Yourself

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**Now connect the dots.** If someone *really* wanted to find out about you online, given the information above, what would they know about you?

**Of the pieces of information you found above, which do you think poses the biggest threat to your security or privacy? Why do you think so?**

# Discussion

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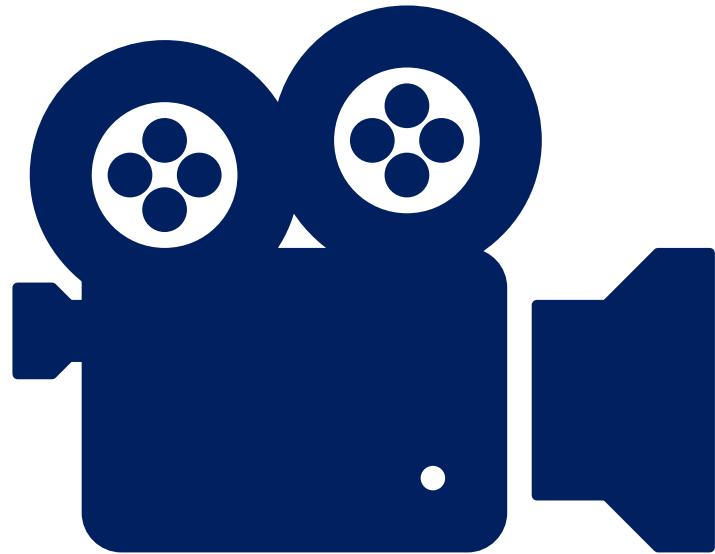
- Why is it significant that you are one of only a few people with your birthday, gender, and ZIP code? What concerns does this raise?
- We can be uniquely identified from just a few pieces of information.
- Even information we would not normally consider to be “sensitive” can still be used to identify us.
- There are security and privacy concerns raised as a result of most information about us being available online.



# Data Privacy Concerns

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ACTIVITY



# Teen Voices: Oversharing and Your Digital Footprint

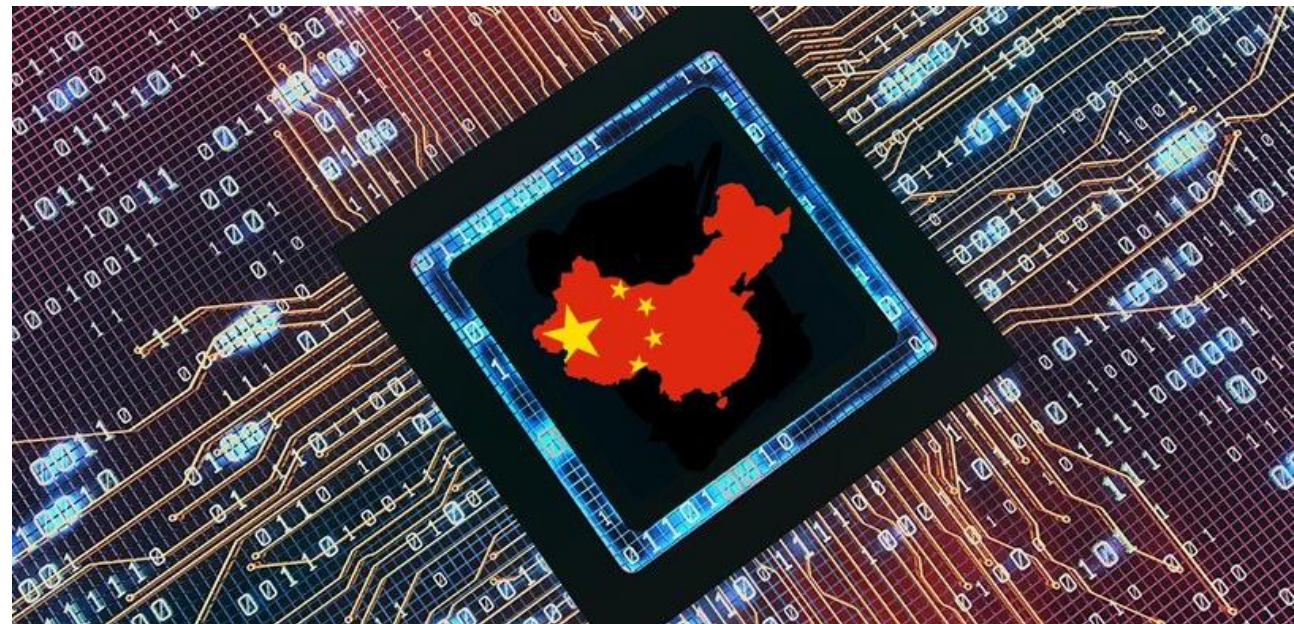
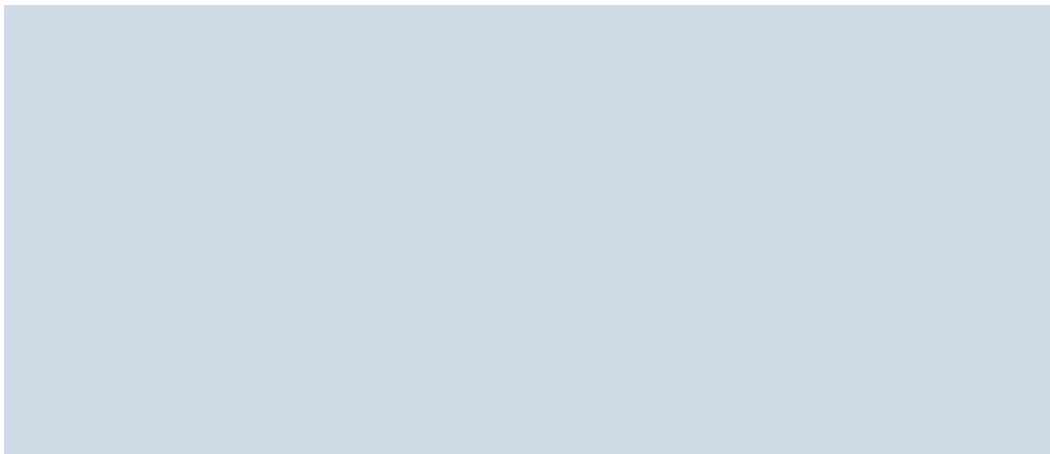
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VIDEO - [HTTPS://YOUTU.BE/OTTNH427FR8](https://youtu.be/OTTNH427FR8)



All kinds of personal data, from usernames to social security numbers and credit card information, is lost fairly regularly. This information can be used to steal money or identities, get access to classified information, blackmail people, etc.









# Intellectual Property

LESSON 12

# Objectives

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- Explain how copyright and Creative Commons Licenses can be applied to digital works of creativity
- Argue if current copyright laws are helping or harming society using evidence from an article

# Vocabulary

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**Intellectual Property:** Intellectual property refers to the ownership of intangible and non-physical goods. This includes ideas, names, designs, symbols, artwork, writings, and other creations. It also refers to digital media, such as audio and video clips that can be downloaded online.

**Creative Commons Licenses:** A Creative Commons (CC) license is one of several public copyright licenses that enable the free distribution of an otherwise copyrighted "work". A CC license is used when an author wants to give other people the right to share, use, and build upon a work that they (the author) have created. CC provides an author flexibility (for example, they might choose to allow only non-commercial uses of a given work) and protects the people who use or redistribute an author's work from concerns of copyright infringement as long as they abide by the conditions that are specified in the license by which the author distributes the work.

# Vocabulary

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**MIT License:** The MIT License is a permissive free software license originating at the Massachusetts Institute of Technology (MIT) in the late 1980s. As a permissive license, it puts only very limited restriction on reuse and has, therefore, high license compatibility.

**Digital Millennium Copyright Act (DMCA):** The Digital Millennium Copyright Act (“DMCA”) provides safe harbors from copyright infringement liability for online service providers. In order to qualify for safe harbor protection, certain kinds of service providers—for example, those that allow users to post or store material on their systems, and search engines, directories, and other information location tools— must designate an agent to receive notifications of claimed copyright infringement.

# Vocabulary

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**Crowdfunding:** GoFundMe

**Crowdsourcing:** CodePen

**Open source:** Github

**Plagiarism:** Illegal use of other people's work

## A vibrant, stylized illustration depicting the interconnectedness of digital marketing and business operations. At the top center, a glowing yellow lightbulb symbolizes ideas and innovation. To its left is a smartphone, and to its right is a laptop displaying a website. Below the lightbulb, a megaphone represents communication and outreach. In the foreground, four hands are shown: one holding a stack of US dollar bills, another holding a single bill, a third holding a coin, and a fourth holding a credit card. These elements are all linked by a network of dashed lines, suggesting a complex digital ecosystem. Various icons like checkmarks, plus signs, and a globe are scattered throughout, reinforcing themes of success, growth, and global reach. The bottom of the image is framed by a row of interlocking gears in yellow and blue, symbolizing the mechanical and systematic nature of business processes.





# OPEN SOURCE

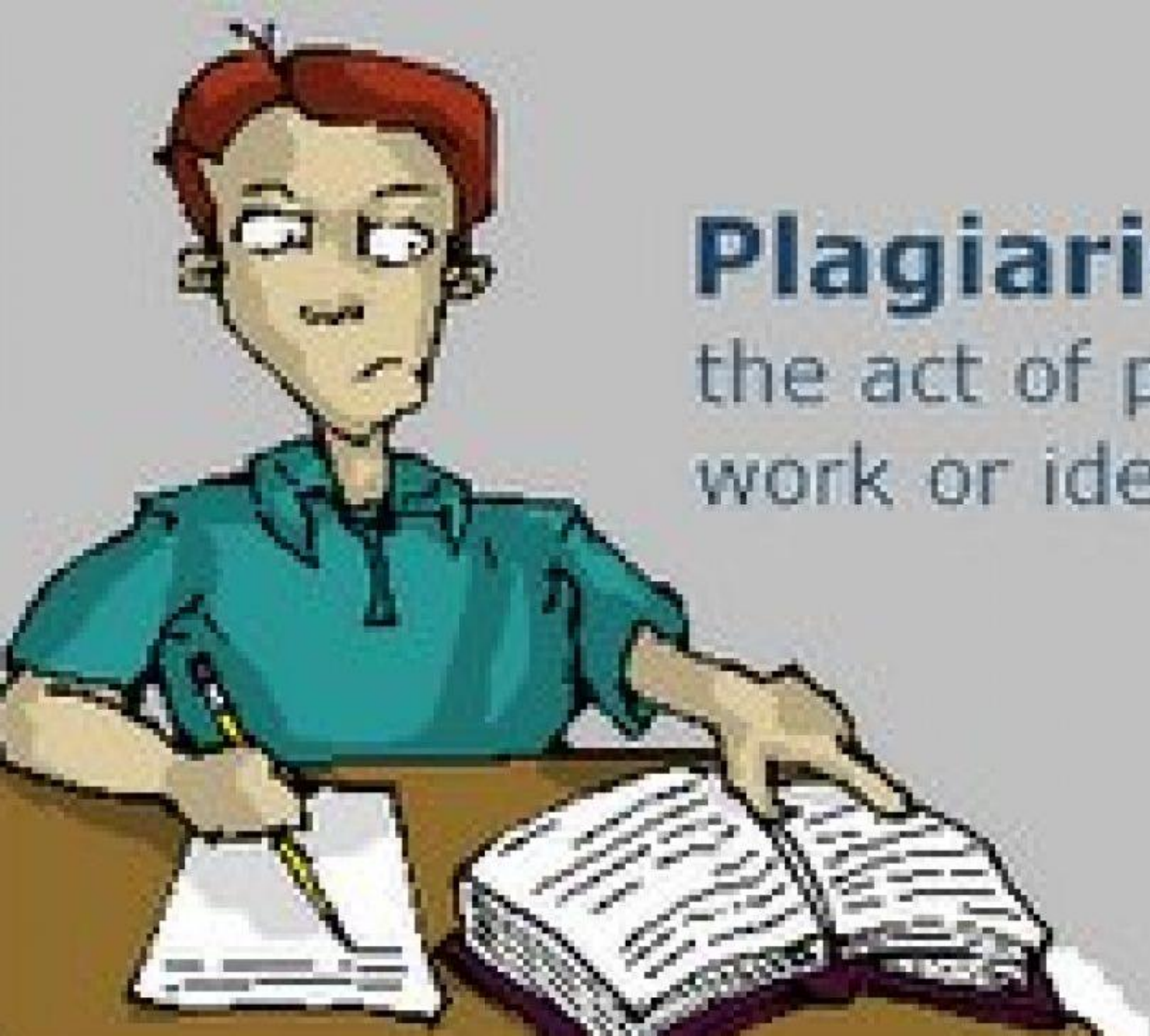
CKAN is **FREE** to Download and use

More than 200 extensions



 **GitHub**  
[GitHub.com/ckan/ckan](https://github.com/ckan/ckan)





## **Plagiarism:**

the act of presenting another's work or ideas as your own.



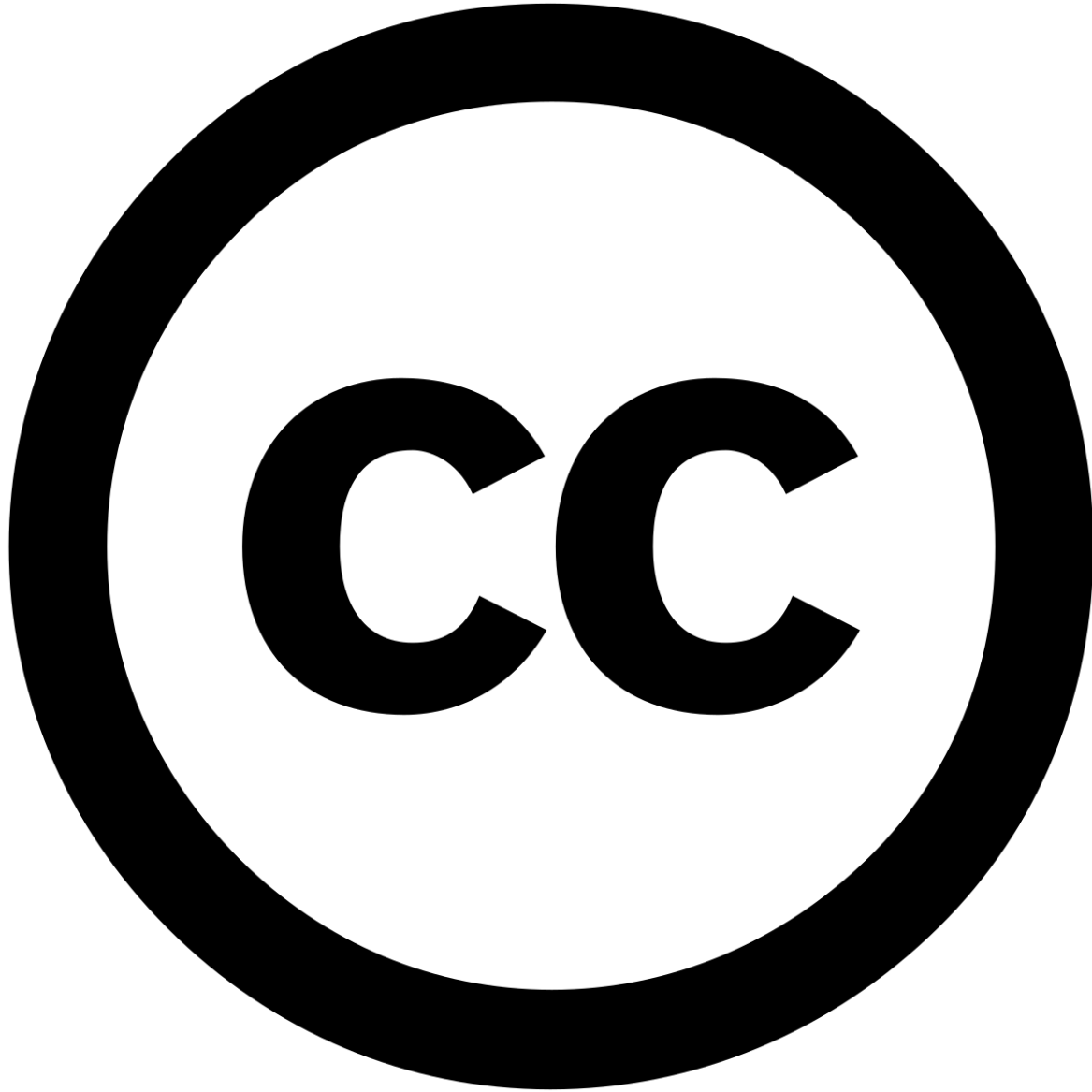
# Video

[HTTPS://YOUTU.BE/GPNWVU\\_IPHU](https://youtu.be/GPNWVU_IPHU)



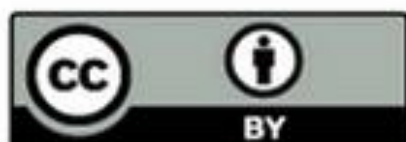
# Video

[HTTPS://YOUTU.BE/ITASCSXNBQW](https://youtu.be/ITASCSXNBQW)



# Video: Creative Common Copyrights

[HTTPS://YOUTU.BE/WC-M23T7CPM](https://youtu.be/WC-M23T7CPM)



## Attribution

Others can copy, distribute, display, perform and remix your work if they credit your name as requested by you



BY



## No Derivative Works

Others can only copy, distribute, display or perform verbatim copies of your work



ND



## Share Alike

Others can distribute your work only under a license identical to the one you have chosen for your work



SA



## Non-Commercial

Others can copy, distribute, display, perform or remix your work but for non-commercial purposes only.



NC



							
Type	Permissive	Permissive	Permissive	Permissive	Copyleft	Copyleft	Copyleft
Provides copyright protection	✓ TRUE	✓ TRUE	✓ TRUE	✓ TRUE	✓ TRUE	✓ TRUE	✓ TRUE
Can be used in commercial applications	✓ TRUE	✓ TRUE	✓ TRUE	✓ TRUE	✓ TRUE	✓ TRUE	✓ TRUE
Provides an explicit patent license	✓ TRUE	✗ FALSE	✗ FALSE	✗ FALSE	✗ FALSE	✗ FALSE	✗ FALSE
Can be used in proprietary (closed source) projects	✓ TRUE	✓ TRUE	✓ TRUE	✓ TRUE	✗ FALSE	✗ FALSE partially	✗ FALSE for web
Popular open-source and free projects	Kubernetes Swift Firebase	Django React Flutter	Angular.js JQuery, .NET Core Laravel	Joomla Notepad++ MySQL	Qt SharpDevelop	SugarCRM Launchpad	

# Discussion

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- Now that we better understand the rules & controls of copyright, we're going to re-read this article to see if we can determine if current copyright policies are helping or hurting society