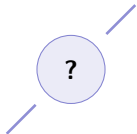


# Impact of Computing

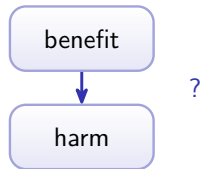
AP Computer Science Principles ■ Unit 5

AP Computer Science Principles



## What we will cover

- 1 Beneficial & harmful effects
- 2 The digital divide
- 3 Computing bias
- 4 Crowdsourcing
- 5 Legal & ethical concerns
- 6 Safe computing





## Beneficial & harmful effects

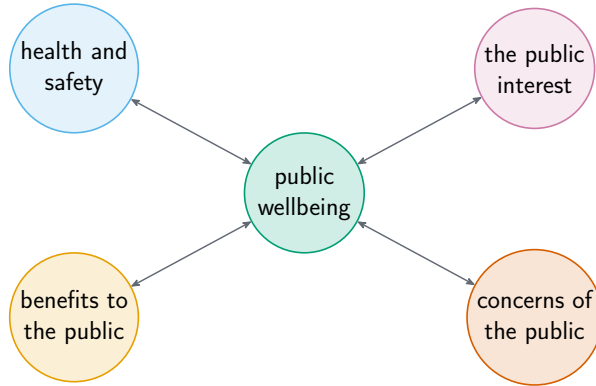
Every **computing innovation** can be both **beneficial** and **harmful** – often to different people at once (a ride-share app helps riders, hurts taxis).

Judge an innovation by weighing **both** sides. It can also bring **unintended consequences** beyond its intended purpose (a map app that tracks where users go).



*Computing has beneficial and harmful effects*

# Beneficial and Harmful Effects



The **same** innovation usually does both at once: a social network connects people *and* spreads misinformation; automation raises output *and* removes jobs. An answer that names only one side does not score.

# The digital divide

The **digital divide** is the unequal **access** to computing and reliable Internet across groups – by income, geography, age or country. Those with access gain in education, work and services; those without fall further behind, which is why the gap widens by itself.

**Narrows** the divide  
subsidised broadband, public Wi-Fi

**Widens** the divide  
leaving regions unconnected

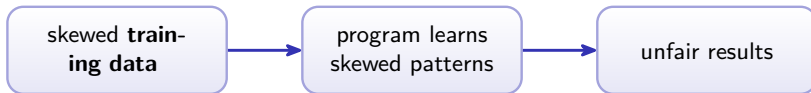
Access shapes opportunity, so many programs aim for **equity** .



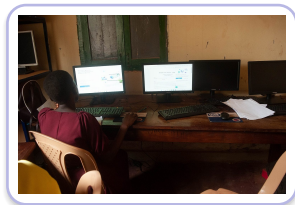
*Access is uneven across communities*



# Computing bias



**Computing bias** is unfairness built into a program, often from unrepresentative data. Testing with **diverse** users reveals it before release.



*Public access can reduce the digital divide*

# Where bias enters a computing system

**bias**

can be built in, and often unintentionally

**through the data**

if the training data reflects existing prejudice, the system reproduces it

**through the designers**

choices about what to measure, and for whom, carry the designers' own assumptions

**through who is missing**

a system tested only on one group fails on the groups it never saw

**the remedy**

diverse teams, diverse test data, and auditing outputs rather than trusting intentions

“Unintentional” does not mean harmless. A biased system at scale affects more people than any biased individual could.

# Crowdsourcing

**Crowdsourcing** obtains input, ideas or funding from a **large group of people**, usually online – harnessing the knowledge and effort of many. Mapping projects, **citizen science**, and crowdfunding all work this way.

**Strength:** diverse, large-scale, shared effort

**Challenge:** **quality** control  
– not everyone is careful

Showing each item to several people and keeping the majority answer protects quality.



*Crowdsourcing pools many contributors*



## Legal & ethical concerns

**Intellectual property** and **copyright** protect a creator's work, so using it may need permission or a licence – **open-source** and Creative Commons licences grant that permission in advance. **Plagiarism**, passing off someone's work as your own, is unethical and often illegal. Collecting personal data raises **privacy** questions about consent and misuse.

**Copyright**  
protects creators

**Creative Commons**  
permission in advance

**Open-source**  
free to use & improve

Beyond the law lies **ethics** : using data legally is not always ethical – surveillance is the standing example. Respect **privacy**, be honest, and credit others.

# Legal, ethical, and safe – three different questions

## the principle

just because something is **technically possible** does not make it legal or ethical

## intellectual property

copyright covers code and content; **Creative Commons** licences state in advance what reuse is allowed

## open source

source made freely available under a licence – free to use is not the same as free of conditions

## PII

personally identifiable information – name, address, ID numbers – shared carefully, because it enables **identity theft**

## protecting it

strong unique passwords, **multifactor authentication**, and **encryption** in transit and at rest

Answer with the **specific** risk, not “it is dangerous”: what could be taken, by whom, and what stops them.

# Safe computing

Guard your **personally identifiable information** (PII). Threats:  
**phishing** , **malware** , social engineering.

## Symmetric

one shared key locks  
& unlocks – fast

## Asymmetric

public key locks, private  
key unlocks – secure sites

**Encryption** plus strong **authentication** (two-factor login) keep data  
safe.



*Hardware has  
environmental costs*

## Key points

Innovations bring **benefits, harms** & unintended effects

The **digital divide** & **computing bias** raise fairness

**Copyright**, Creative Commons & open-source; ethics

**Encryption** & authentication for safe computing

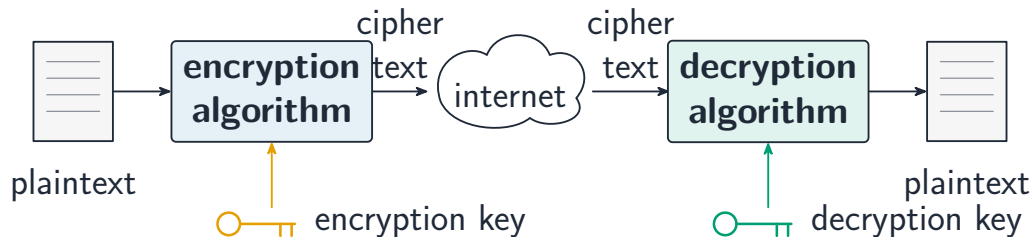
## Worked example – naming a bias, and its cause

**A hiring algorithm trained on past hires (mostly one group) now rejects qualified applicants from other groups**

Name it: this is **computing bias**, caused by **biased training data** – the model learned the **historical pattern** instead of a fair rule.

A full-mark answer states the **harm** (qualified people are unfairly rejected) **and** its **cause** (the bias came from the **data**, not the code).

## Check yourself, in detail



Encryption scrambles plaintext with a key; only the key can decrypt it

## Exam tips

- Argue **both** the beneficial and harmful effects of a computing innovation – a balanced answer scores best.
- Use correct terms for data concerns: **PII**, privacy, security, and **algorithmic bias**.
- Explain how **crowdsourcing** and large data sets create value and raise new risks.
- Distinguish the **digital divide** (access) from bias (fairness) and give a concrete example of each.
- Tie every claim to a specific innovation and effect, as the written response demands.



## Unit 5 – key takeaways

1

### Both sides

beneficial *and* harmful effects

2

### Data

PII, privacy, security, algorithmic bias

3

### Crowdsourcing

value and new risks from large data

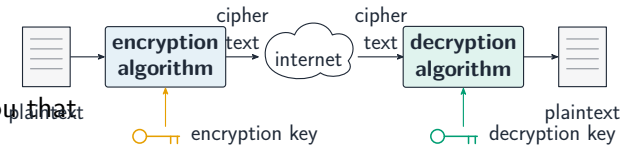
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### Divide vs bias

access vs fairness – give an example of each

## Check yourself

- 1 A model trained on skewed data discriminates. Where is the bias?
- 2 What is the digital divide?
- 3 What does crowdsourcing get you that one team cannot?
- 4 Name one legal concern when reusing someone's code.



**Answers** 1. in the training data, not the code 2. unequal access to computing  
3. scale and many perspectives 4. copyright / licensing – credit the source