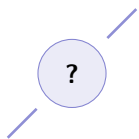
Impact of Computing

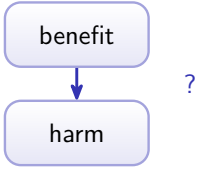
AP Computer Science Principles ▪ Unit 5

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



1 Effects & access

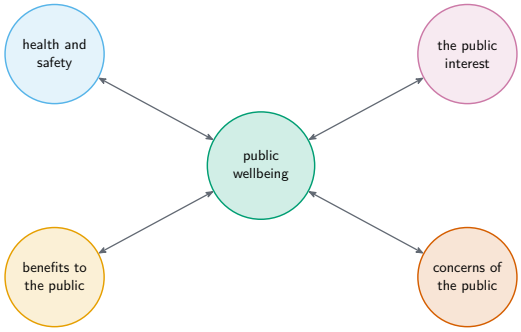
Beneficial & harmful effects

Every **computing innovation** 计算创新 can be both **beneficial** 有益的 and **harmful** 有害的 – 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** 意外后果 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** 数字鸿沟 is the unequal **access** 访问 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

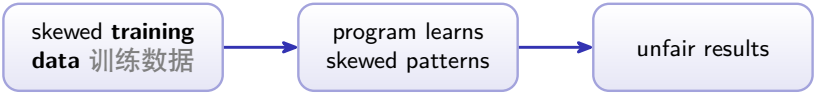
Widens the divide
leaving regions unconnected

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

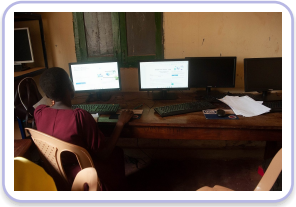
Access is uneven across communities

2 Bias & crowdsourcing

Computing bias



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



Public access can reduce the digital divide

Where bias enters a computing system

bias 偏见	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.

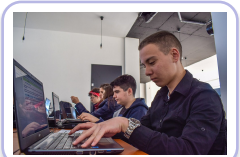
Crowdsourcing

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

Strength: diverse, large-scale, shared effort

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

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



Crowdsourcing pools many contributors

3 Legal, ethical & safe

Legal & ethical concerns

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

Copyright 版权
protects creators

Creative Commons 知识共享
permission in advance

Open-source 开源
free to use & improve

> Beyond the law lies **ethics** 伦理: using data legally is not always ethical – surveillance is the standing example. Respect **privacy** 隐私, 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 知识产权	copyright covers code and content; **Creative Commons** 知识共享 licences state in advance what reuse is allowed
open source 开源	source made freely available under a licence – free to use is not the same as free of conditions
PII 个人身份信息	personally identifiable information – name, address, ID numbers – shared carefully, because it enables **identity theft** 身份盗窃
protecting it	strong unique passwords, **multifactor authentication** 多因素身份验证, and **encryption** 加密 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** 个人身份信息 (PII). Threats: **phishing** 网络钓鱼, **malware** 恶意软件, social engineering.

Symmetric 对称
one shared key locks & unlocks – fast

Asymmetric 非对称
public key locks, private key unlocks – secure sites

Encryption 加密 plus strong **authentication** 身份验证 (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

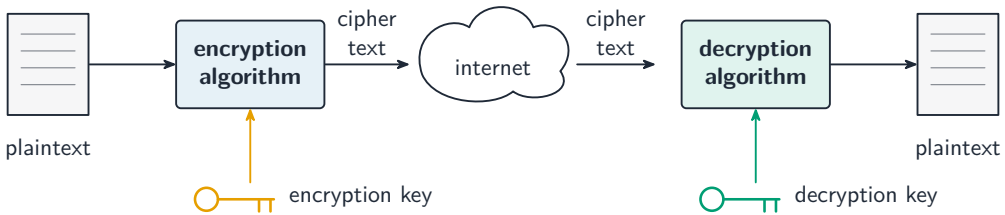
Worked example – naming a bias, and its cause

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.

4 Recap

Unit 5 – key takeaways

1 Both sides

beneficial *and* harmful effects

2 Data

PII, privacy, security, algorithmic bias

3 Crowdsourcing

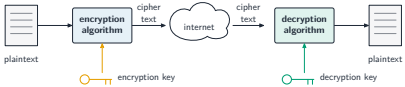
value and new risks from large data

4 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