Impact of Computing

AP Computer Science Principles ▪ Unit 5

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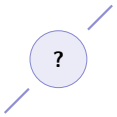
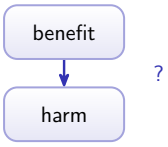


What we will cover

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



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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

The digital divide

The **digital divide** 数字鸿沟 is the gap in **access** 访问 to computing and reliable Internet – shaped by income, geography & age.

Narrows the divide	**Widens** the divide
subsidised broadband, public Wi-Fi	leaving regions unconnected

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

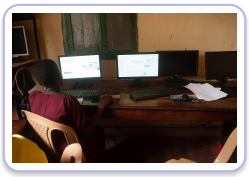
Access is uneven across communities

2 Bias & crowdsourcing

Computing bias

skewed **training data** 训练数据 → program learns skewed patterns → unfair results

> **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

Crowdsourcing

Crowdsourcing 众包 gathers input, content or money from a large online crowd (e.g. **citizen science** 公民科学).

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

Copyright 版权 protects creators

Creative Commons 知识共享 permission in advance

Open-sourc free to & imp

Surveillance and privacy collide in computing

Beyond the law lies **ethics** 伦理: using data legally is not always ethical – respect **privacy** 隐私, be honest, and credit others.

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

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