UNIVERZA V LJUBLJANI

FRI

Fakulteta za računalništvo in informatiko

Exam Preparation

Sustainable Computing

Aneta Kartali

Ljubljana, 14.01.2026.

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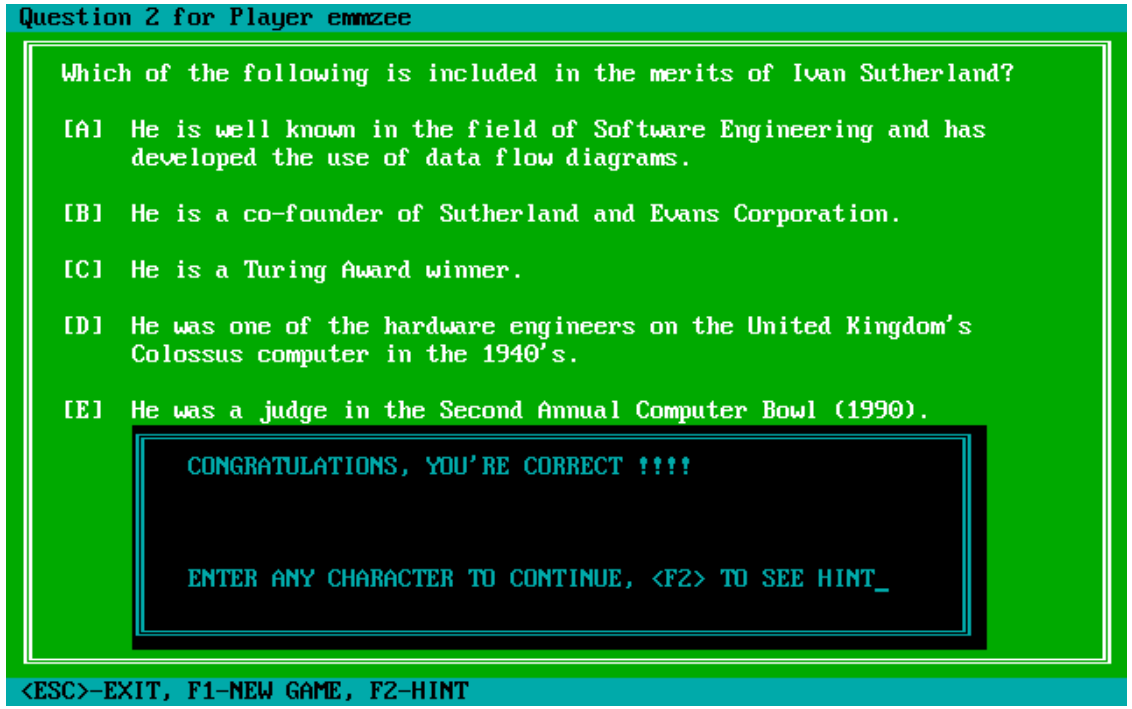
NOTICE:

This lab session is created based on the course materials and is purposely designed as a quiz. The exam questions will be open-ended. **You will NOT have multiple answer questions but will be required to write from paragraph-long to essay-long answers.**

Quiz rules

- You will compete in teams
- 7 question categories covering lecture themes
- 25 questions – 1 minute per question
- A prize for the team with most points at the end



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Question categories

1. Core problems of sustainable computing
2. Measuring the impact
3. Mobile & IoT sustainability
4. Techniques & trade-offs
5. Design for sustainability
6. Frameworks & models
7. Policy & ethics

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Core problems

Category 1

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1. What is meant by a *“wicked problem”*?

A. A problem with a single clear solution
B. A problem that is difficult because of poor algorithms
C. A problem that has no definitive solution and involves many stakeholders
D. A problem that can be solved by more computing power
E. A problem caused mainly by software bugs

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2. What does "program profiling" mean and how does it help making software more sustainable?

A. Measuring where a program spends time and resources
B. Making programs shorter
C. Identifying energy- and resource-intensive parts of code
D. Encrypting software to make it safer
E. Helping optimize software to use fewer resources

```
                     Call graph (explanation follows)

gpranularity: each sample hit covers 2 byte(s) for 2.25% of 0.44 seco

index % time    self  children    called     name
                                                 <spontaneous>
[1]    100.0    0.01    0.43                 main [1]
                0.29    0.00 1000000/1000000     b_fact [2]
                0.14    0.00 1000000/1000000     a_fact [3]
-----------------------------------------------
                             49000000             b_fact [2]
                0.29    0.00 1000000/1000000     main [1]
[2]     65.9    0.29    0.00 1000000+49000000 b_fact [2]
                             49000000             b_fact [2]
-----------------------------------------------
                0.14    0.00 1000000/1000000     main [1]
[3]     31.8    0.14    0.00 1000000         a_fact [3]
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3. Which are common and obvious optimization targets in programming code?

A. Use of classes
B. Data structures
C. Loops
D. Code comments
E. Recursions

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Core problems

Answers

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Measuring impact

Category 2

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4. What best describes *Software Carbon Intensity (SCI)*?

A. The total cost of running software
B. The carbon emissions per unit of useful work done by software
C. The speed of a program
D. The size of the codebase
E. The number of users

We are building a trusted ecosystem of people, standards, tooling and best practices for

GREEN SOFTWARE

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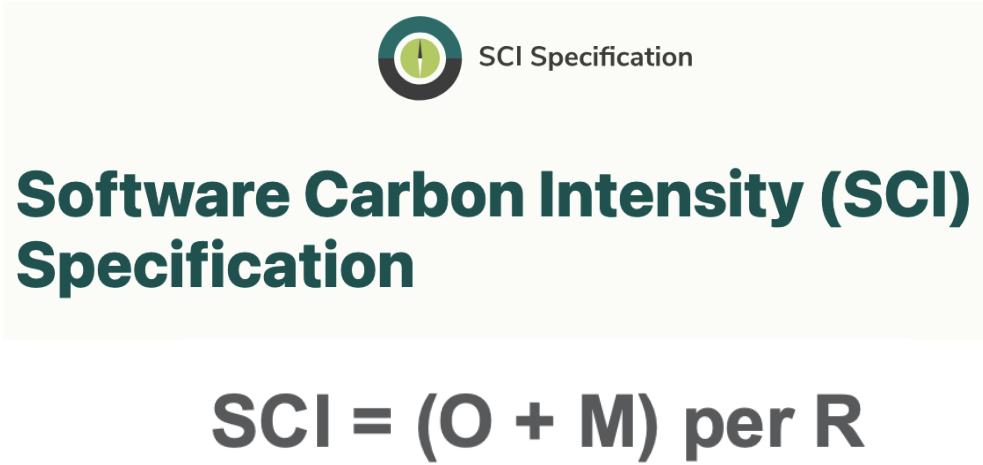
5. Which elements are part of the SCI calculation?

A. Energy consumption
B. Carbon intensity of electricity
C. Embodied emissions of hardware
D. Number of developers
E. Functional unit (e.g., per request)



6. Which are general guidelines for green software engineering?

A. Measure before optimizing
B. Avoid unnecessary computation
C. Prefer efficient algorithms and data structures
D. Always maximize graphical quality
E. Use renewable energy where possible

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Measuring impact

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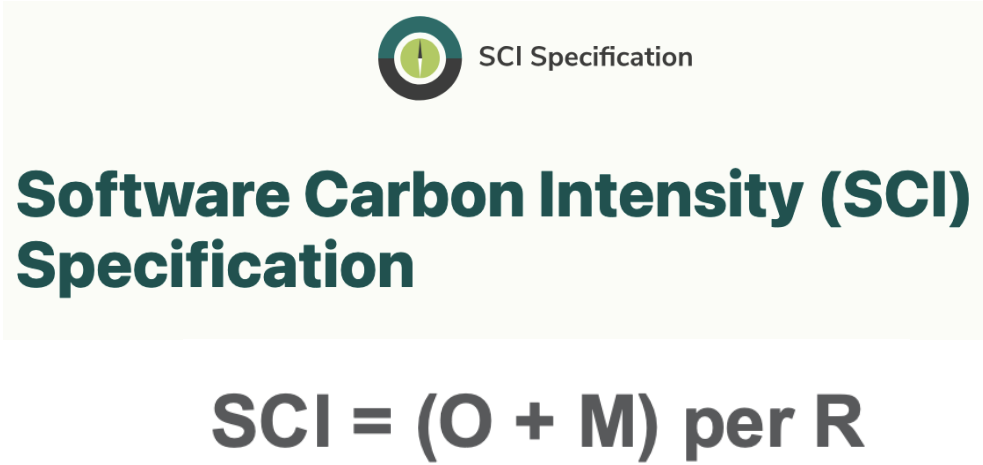

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Mobile & IoT sustainability

Category 3

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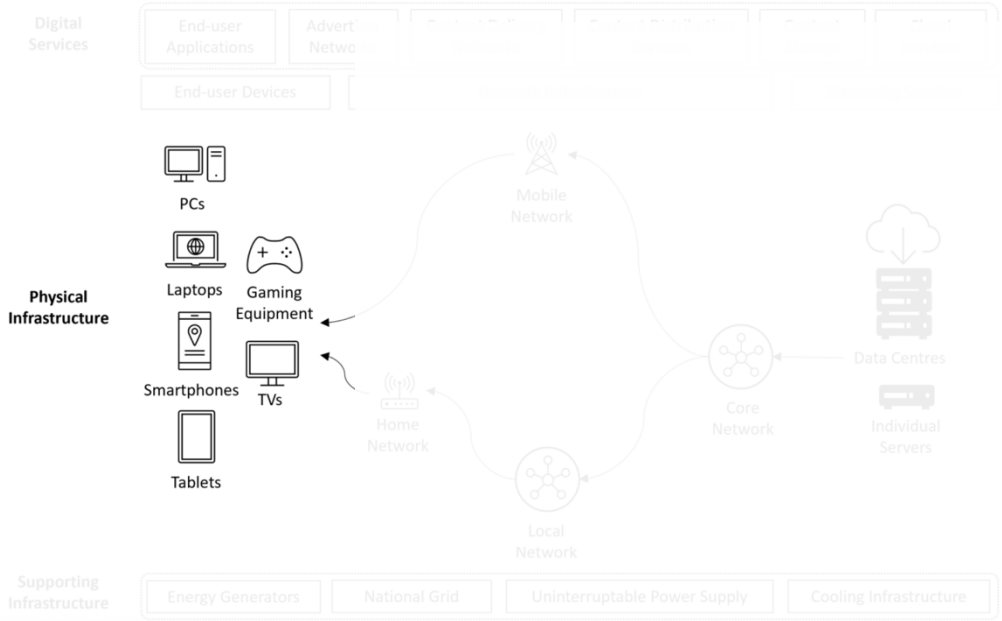
7. For mobile and IoT computing, what can be said about Scope 2 and Scope 3 emissions?

A. Scope 2 is usually much larger than Scope 3
B. Scope 3 emissions often dominate
C. They are always equal
D. Scope 3 is often larger than Scope 2
E. Scope 2 does not exist for IoT

8. What does *"taking the whole picture into account"* mean when assessing mobile/IoT impact?

A. Only looking at energy used during execution
B. Considering manufacturing, usage, and disposal
C. Ignoring user behavior
D. Including infrastructure and networks
E. Focusing only on software



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9. Which are common issues with e-waste recycling?

A. Toxic materials
B. Informal and unsafe recycling practices
C. Loss of valuable materials
D. Perfect recovery rates
E. Export to developing countries

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10. Which measures can make mobile/IoT computing more sustainable?

A. Energy-efficient hardware
B. Longer device lifetimes
C. Increased service quality
D. Frequent device replacement
E. Software updates instead of new hardware

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Mobile & IoT sustainability

Answers

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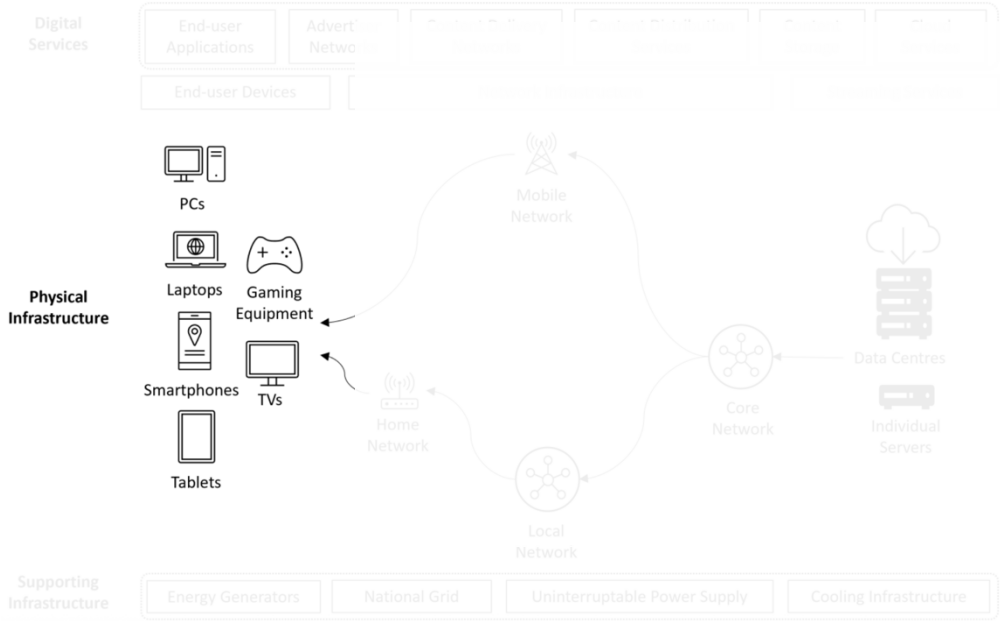

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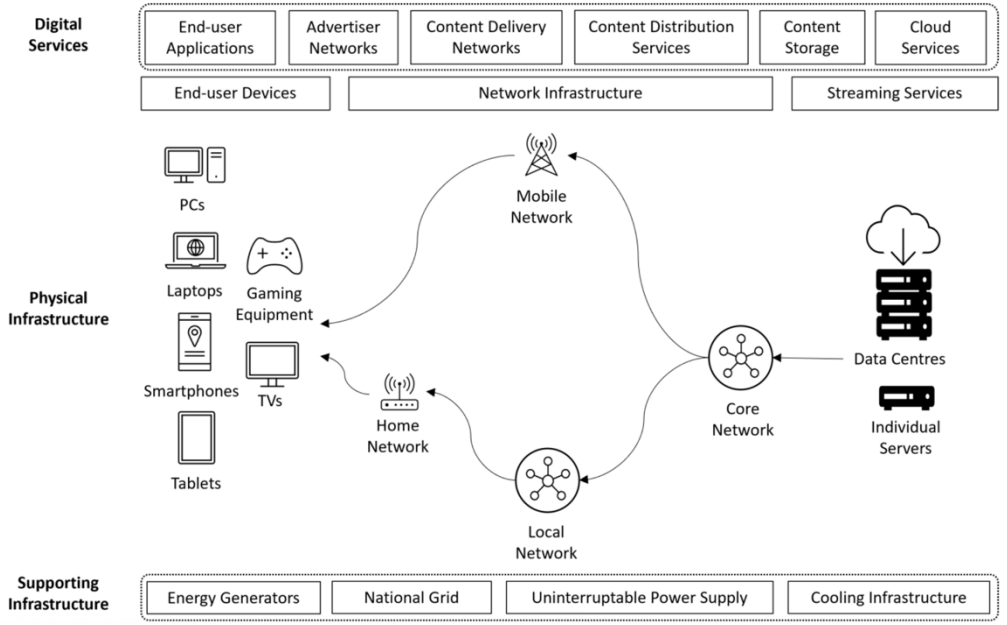

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Techniques & trade-offs

Category 4

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11. What is duty cycling?

A. Turning devices on and off periodically
B. Running hardware at maximum speed
C. Keeping sensors active all the time
D. Saving energy by sleeping when not needed
E. Improving efficiency with minimal loss of service quality

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12. What is hierarchical sensing?

A. All sensors always active
B. Using low-power sensors first, high-power only when needed
C. Collecting data randomly
D. Storing all data locally
E. Always reducing sensing accuracy

13. How can reducing Quality of Service (QoS) save resources in mobile computing?

A. Lower resolution or sampling rates
B. Higher battery drain
C. Reduced computation
D. Increasing network traffic
E. Lower screen brightness

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14. Reducing resource usage can harm usability. How can this be mitigated?

A. Adaptive quality based on context
B. User control over settings
C. Clear communication to users
D. Always using lowest quality
E. Enabling precise sensor measurements

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Techniques & trade-offs

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Design for sustainability

Category 5

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15. Which questions are central to Sustainable Interaction Design (SID)?

A. Is the design visually impressive?
B. Does the design provide for transfer of ownership?
C. Does it cause the disposal of physical material?
D. Does it promote overuse?
E. Does the design motivate preservation?

16. Which unrealistic expectations does the Sustainable Digital Interaction Design (SDID) challenge?

A. Constant need for new services
B. Increasingly high quality
C. Perfect user behavior
D. Ability to deal with peak loads
E. Unlimited storage

17. What questions does SDID pose about infrastructural sustainability of digital solutions?

A. Does the design encourage increased use?
B. Does it encourage digital waste?
C. Can it overcome planetary boundaries?
D. What color is the UI?
E. What happens if usage explodes?

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Design for sustainability

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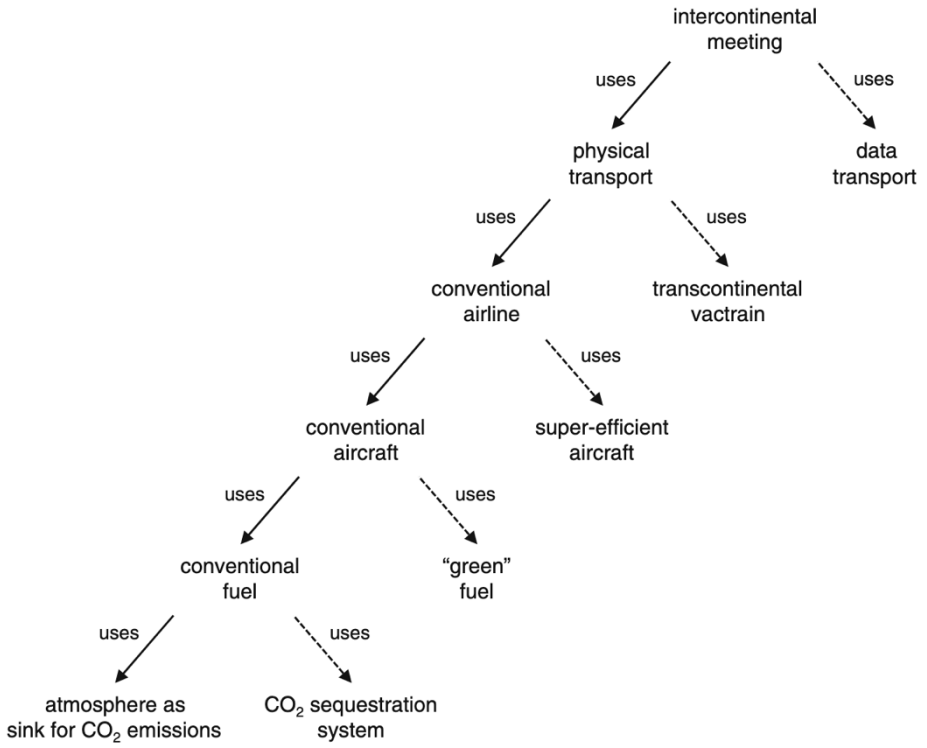
Frameworks & models

Category 6

18. Using the substitution framework, how do virtual meetings compare to air travel?

A. Digital meetings can replace physical travel
B. Digital meetings always increase emissions
C. Substitution can reduce emissions significantly
D. Substitution has no social effects
E. Digital infrastructure also has impacts

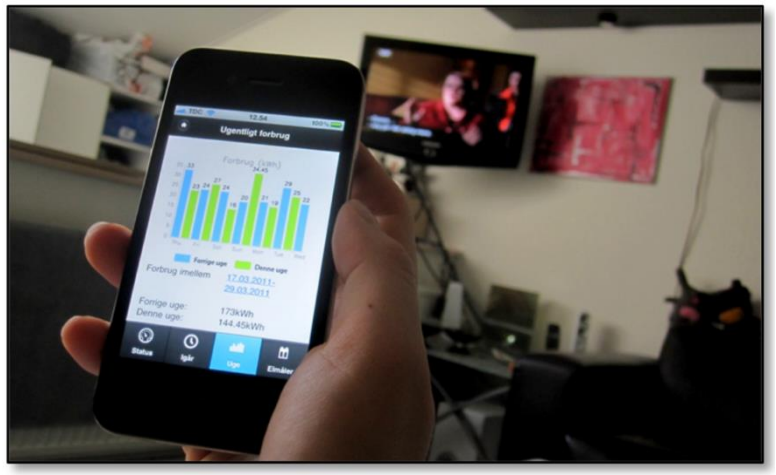


19. What is the difference between sustainability “in design” and “sustainability through design”?

A. “In design” focuses on making the product itself sustainable
B. “Through design” focuses on influencing user behavior
C. They mean the same thing
D. “Through design” can enable systemic change
E. “In design” ignores users

20. Which are common themes in sustainability through design?

A. Behavior change
B. Awareness and feedback
C. Efficiency improvements
D. Short-term profit
E. Social practices



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21. According to the Fogg model, behavior happens when:

A. Motivation is high
B. Ability is sufficient
C. A trigger is present
D. Technology is advanced
E. All three (A, B, C) align

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Frameworks & models

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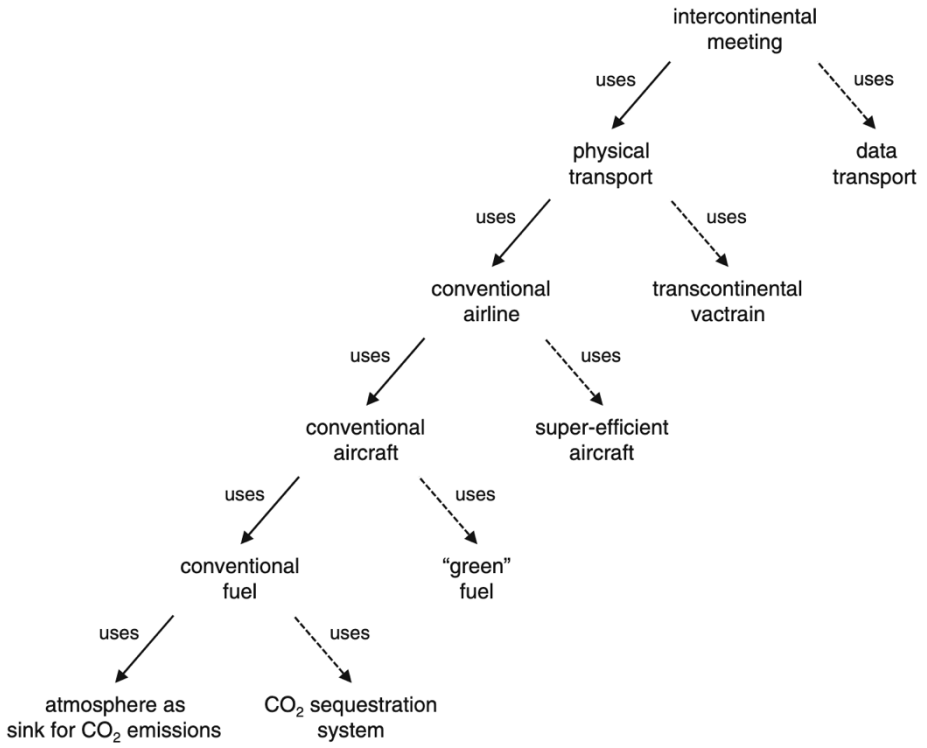

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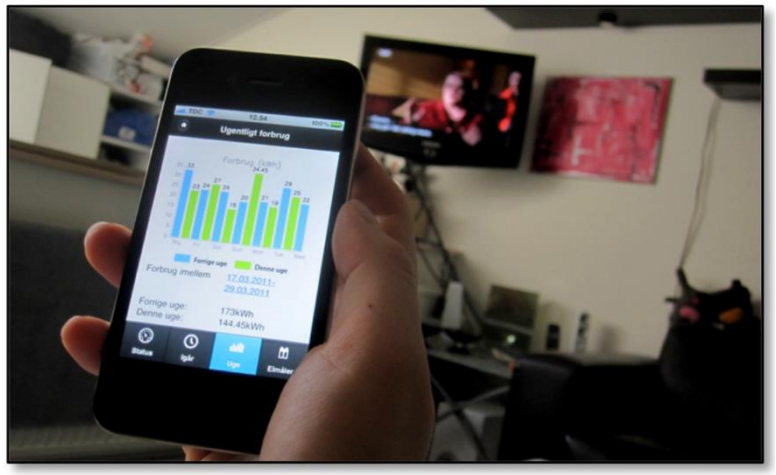

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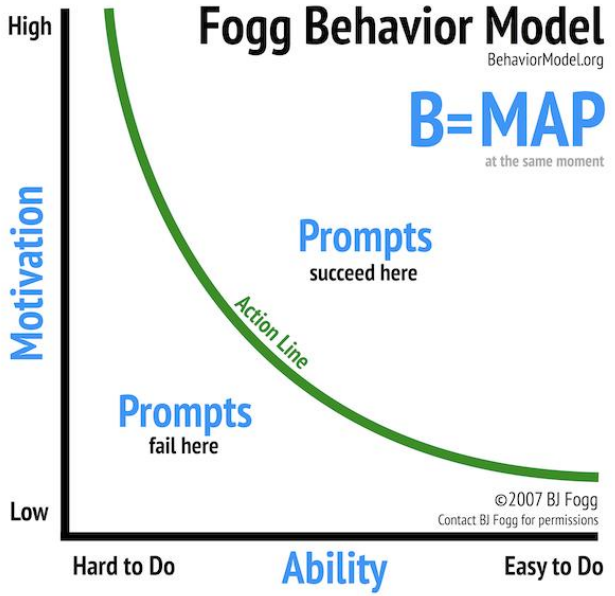

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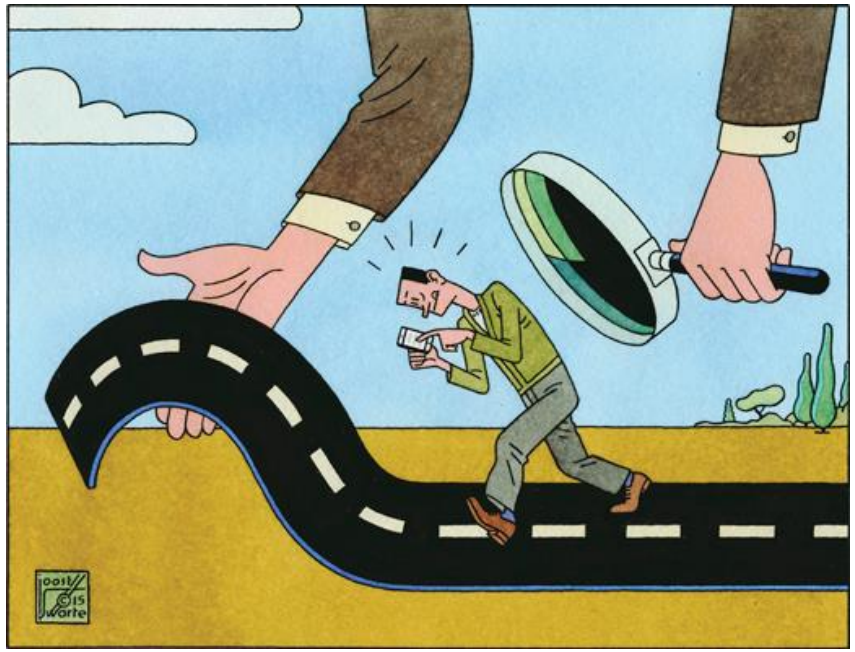
Policy & ethics

Category 7

22. What are concerns about persuasive technology for sustainability?

A. Manipulation of users
B. Ethical concerns
C. Rebound effects
D. None - positive outcomes are guaranteed
E. Loss of autonomy



23. What is green policy informatics about?

A. Using data and models to support environmental policy
B. Optimizing user interfaces
C. Decision support for sustainability
D. Ignoring uncertainty
E. Scenario analysis

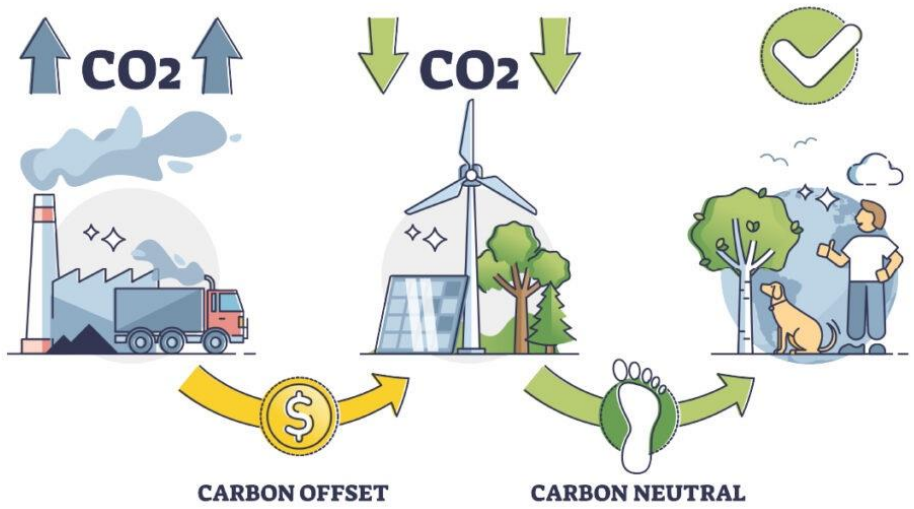
Green Policy

24. What is a life-cycle assessment (LCA)?

A. Evaluating environmental impacts across a product's life
B. Only measuring use-phase energy
C. Including production, use, and disposal
D. A financial audit
E. A one-time measurement

25. Which statements about carbon offsetting are correct?

A. Emissions are compensated elsewhere
B. It removes emissions at the source
C. Quality and permanence can be uncertain
D. It can delay real reductions
E. It guarantees zero climate impact



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Policy & ethics

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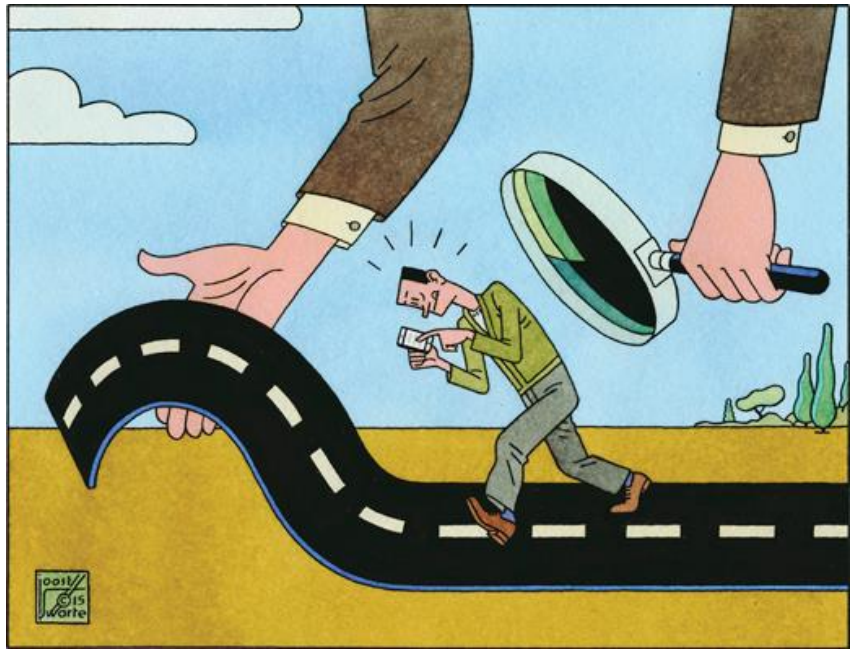

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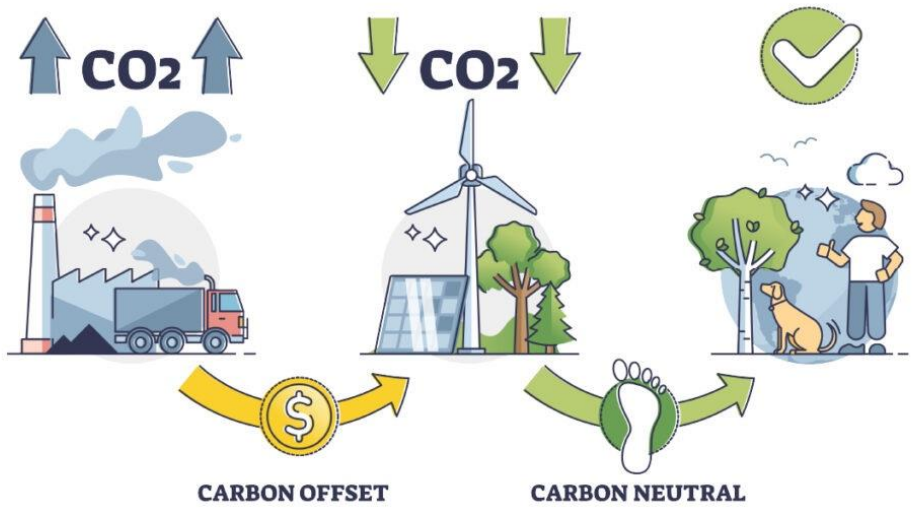

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Sustainability basics for computing

Bonus round

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26. Which of the following are official UN Sustainable Development Goals (SDGs)?

A. Zero hunger
B. Access to internet for everyone
C. Gender equality
D. Religious equality
E. Affordable and clean energy
F. Net zero homes
G. Clean air
H. Clean water and sanitation
I. No greenhouse gas emissions

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27. Which of the following are greenhouse gases?

A. Methane (CH_4)
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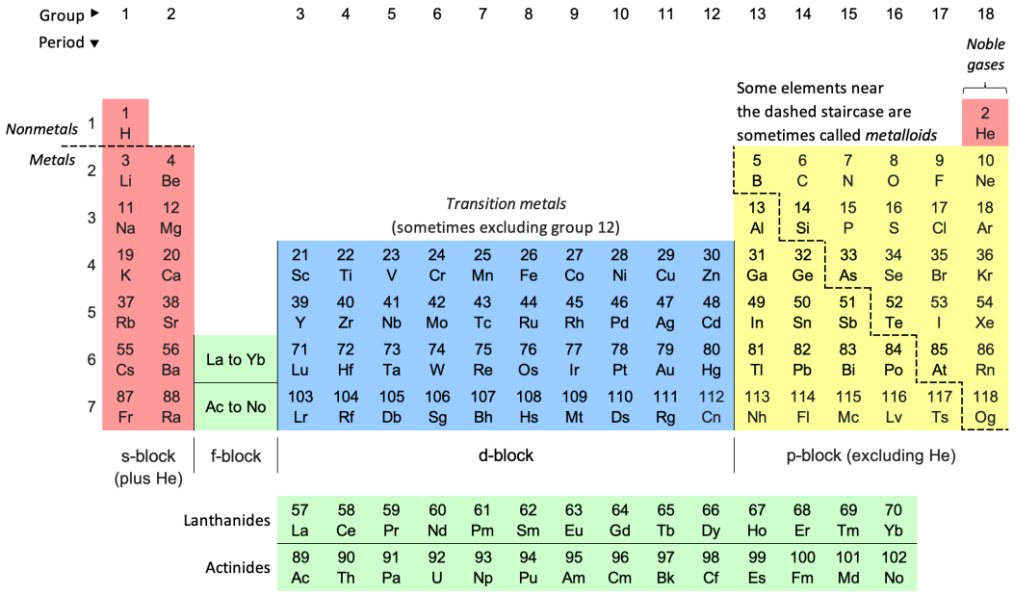

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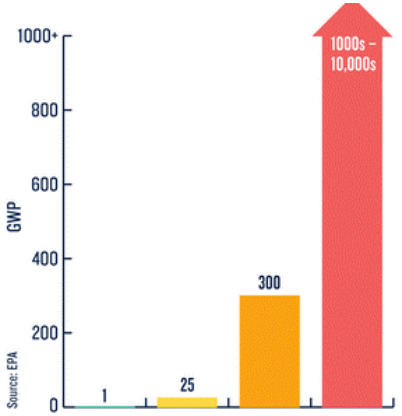
28. What does global warming potential (GWP) measure?

A. How much energy the Earth can absorb
B. How much heat a greenhouse gas traps in the atmosphere compared to CO_2
C. The maximum temperature the Earth can reach
D. How much energy the oceans absorb in one day
E. The speed at which a gas rises in the atmosphere



29. What are planetary boundaries?

A. Natural borders between climate zones
B. Limits defining how much humans can alter Earth systems without destabilizing them
C. Boundaries between continents and oceans
D. The outer edge of the atmosphere
E. Legal environmental thresholds set by the UN

30. What is meant by carbon inequality?

A. Fossil fuels exist only in certain regions
B. A small, wealthy part of the population causes a disproportionate share of emissions
C. Low-emission countries suffer most from climate change impacts
D. Emissions are equally distributed worldwide
E. Carbon pricing affects everyone equally

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Sustainability basics for computing

Answers

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26. Which of the following are official UN Sustainable Development Goals (SDGs)?

A. Zero hunger
B. Access to internet for everyone
C. Gender equality
D. Religious equality
E. Affordable and clean energy
F. Net zero homes
G. Clean air
H. Clean water and sanitation
I. No greenhouse gas emissions

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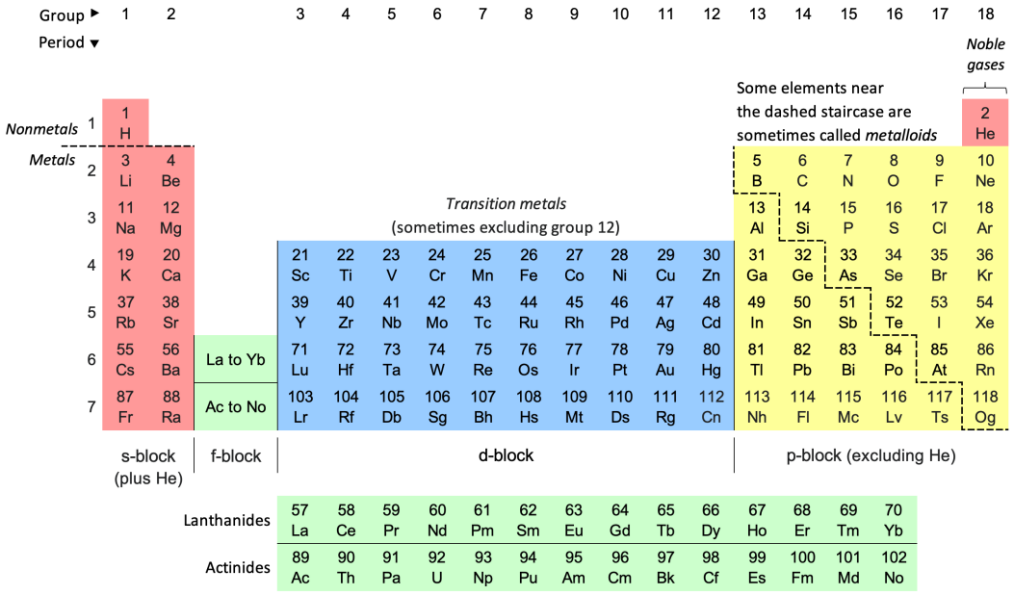

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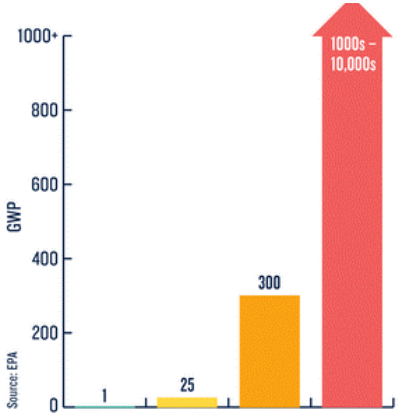

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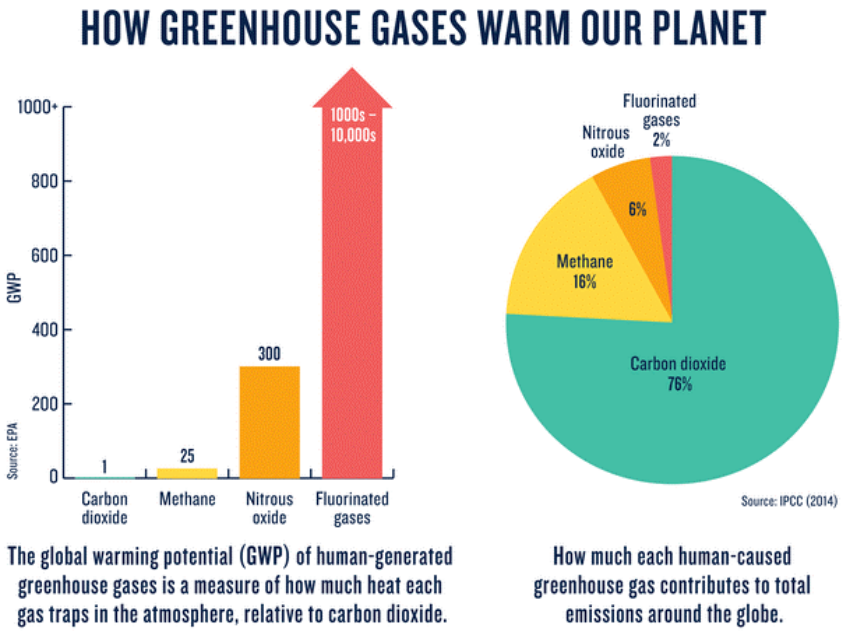

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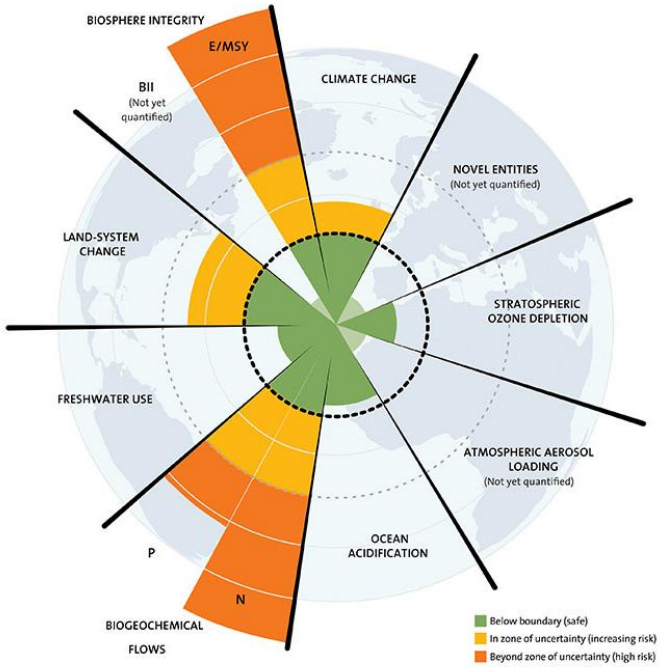

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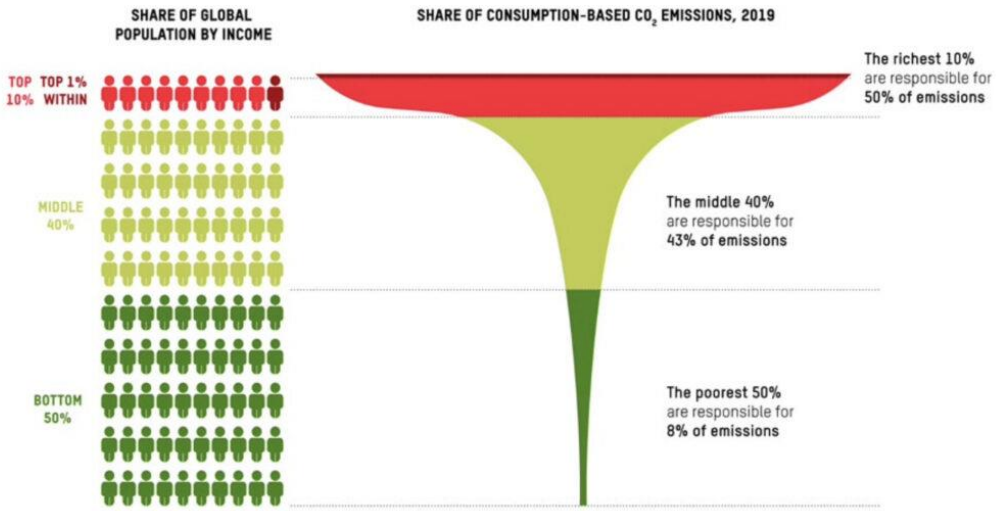

Figure ES.2 Global income groups and associated consumption emissions in 2019. Source: Oxfam/SEI.

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Score board

Team name	1. Core problems	2. Measuring the impact	3. Mobile & IoT sustainability	4. Techniques & trade-offs	5. Design for sustainability	6. Frameworks & models	7. Privacy & ethics	Bonus round	Total score
Team 1	3	2	3.66	3.5	2.5	4	3.41	3.25	22.07
Team 2	3	2	3.5	3.5	2.16	3.75	3.41		21.05
Team 3	2.32	2.5	3.66	3	2.75	4	2.41	3	21.34
Team 4	2.32	2.3	3	3.25	2	3.41	3.5		19.78
Max points	3	3	4	4	3	4	4	5	25