Ethics and Engineering

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Outline

- Two ethical theories
  - Utilitarian, Kantian
- Professional ethics
  - What is it?
- Intellectual property
  - Legal aspects
  - Ethical aspects

Ethical theory

Utilitarian ethics

Origin of utilitarianism

- Jeremy Bentham applied *utilitarianism* to criminal justice in Britain.
  - Punishment should maximize *utility*, not exact retribution.
    - What is utility? You decide. Just stick with your definition.
    - For example, deterrence and rehabilitation may be more effective than retribution.
  - The idea is to be consistent.
    - Utilitarianism is a formal conditional of rationality.

Measuring utility

- For simplicity, we assume that utilities of different persons can be summed like ordinary numbers.
  - There are alternatives: the ranking of actions is invariant under:
    - A positive affine transformation of utilities.
    - A rescaling of utilities.
    - A positive affine transformation with a different constant term for each person, etc.
  - Each implies certain properties for the utility function.

Policy Utilitarianism

- Relying solely on utilitarianism can result in counterintuitive obligations.
  - The inconvenience of my voting outweighs the infinitesimal benefit of one additional vote.
  - Utilitarianism therefore instructs me to stay home on election day.

Policy utilitarianism

- Utilitarianism is better conceived as dictating a utility-maximizing *policy*.
  - So utilitarianism applies to policy makers: corporate boards or officers, government officials, etc.
  - In the case of voting:

$$\begin{aligned} &\text{maximize} && u(S) \\ &\text{subject to} && S \subset \{\text{eligible voters}\} \end{aligned}$$

Utilitarianism and distributive justice

- Everyone has equal weight when summing utilities.
- Yet utilitarianism can endorse unequal distributions if they maximize total utility.
  - Low minimum wage, high CEO salaries, etc.
  - Give lion's share of resources to those who can best use it.
    - Talented, well-born, etc.

Utilitarianism and distributive justice

- Bentham's response: principle of decreasing marginal utility implies some degree of equality.
  - Concentration of resources in a few people may result in less overall utility.
  - Check it out mathematically. Let
    - x_i = resources allotted to person i.
    - $c_i x_i^p$ = utility created by allotment x_i, where $0 \leq p \leq 1$.
    - R = total resources available.

Utilitarianism and distributive justice

- $p = 1$ implies most talented person (largest c_i) gets all the resources; $p = 0$ implies most egalitarian case.
- The optimization problem is

$$\text{maximize} \quad \sum_i c_i x_i^p$$

$$\text{subject to} \quad \sum_i x_i = R$$

  - Associate Lagrange multiplier λ with constraint and obtain for each i

$$\lambda = p c_i x_i^{p-1}$$

Utilitarianism and distributive justice

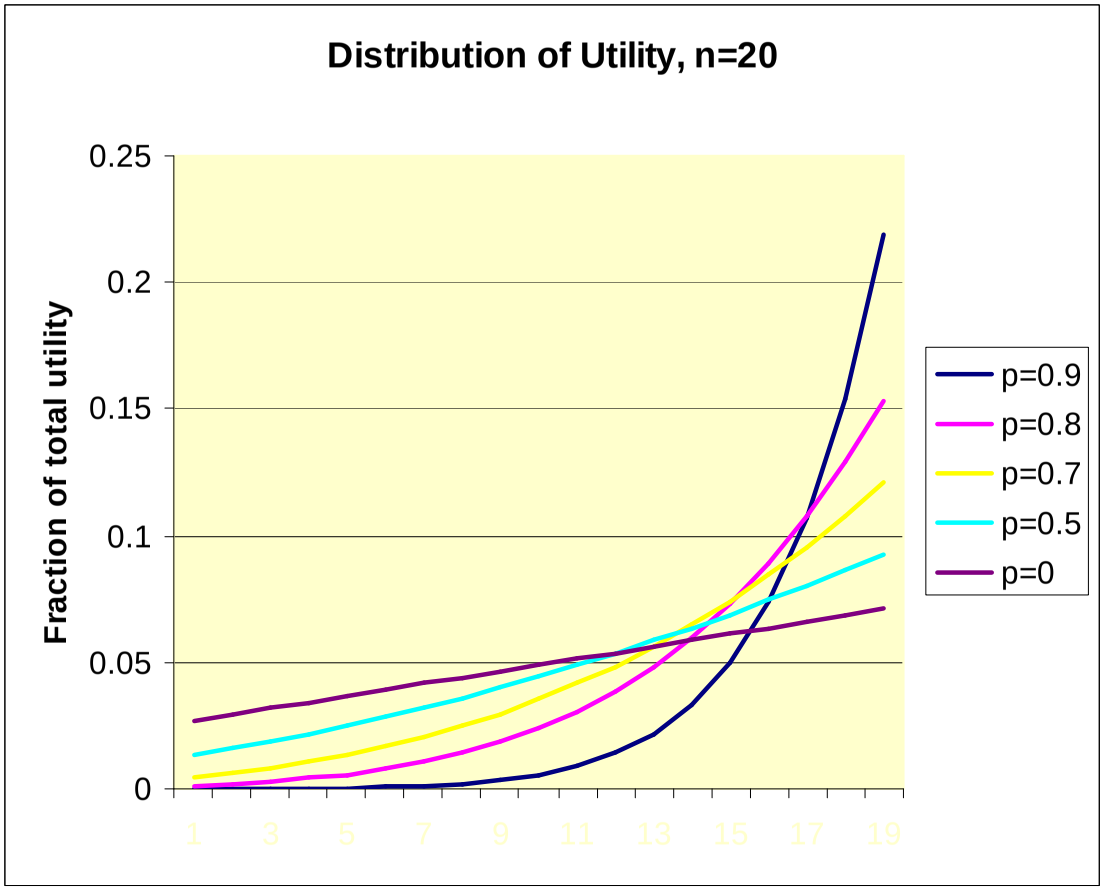
- The optimal allocation of resources x_i and fraction u_i of utility is

$$x_i = R\frac{c_i^{1/(1-p)}}{\sum_j c_j^{1/(1-p)}} \qquad u_i = \frac{c_i^{1/(1-p)}}{\sum_j c_j^{1/(1-p)}}$$

  - As $p \to 0$, allocation becomes proportional to c_i.
  - So the *most* egalitarian distribution utilitarianism allows is to allot persons resources and utility in proportion to their abilities to generate utility.
- Even if the optimal allocation is usually just, it seems unlikely that it is *necessarily* just.

Utilitarianism and distributive justice

$(c_1,\ldots,c_{20}) = (11,\ldots,30)$



Ethical theory

Kantian ethics

Strengths of Kantian ethics

- Applies to individual decisions.
- Accounts for distributive justice.
- Based only on a formal condition for rationality.

Basic premises

- One always acts for a reason (i.e., according to a *maxim*).
  - That is, one always acts to achieve some end.
- If a reason justifies an action for me, it justifies the same action for anyone.

Basic premises

- I stay home from the polls because voting is inconvenient.
- If this is sufficient reason for me, it is sufficient reason for anyone.
  - If not, perhaps it is because some people enjoy voting.
  - Then part of my reason is that I don’t enjoy voting.
  - My maxim is, “Let me stay home if voting is convenient and I don’t enjoy it.”

Generalization test

- But my maxim is actually: Don’t vote if
  - Voting is inconvenient.
  - I don’t enjoy it.
  - Others who find voting inconvenient and unenjoyable will vote anyway.
- This cannot be the rationale for my action because it is inconsistent.
  - Sufficient reasons for me must be sufficient reasons for anyone.

Generalization test

- What is wrong with cheating on an exam?
  - My cheating presupposes that most people don't cheat, even though they have the same reasons to cheat I have.
    - If they cheated, grades would have no meaning and cheating would be impossible.
    - My maxim is, "Let me cheat when it benefits me and when other people whom it benefits will not cheat."
  - This is not a consistent rationale for cheating.

Free rider principle

- Free rider principle is a special case.
  - Nonvoter is a free rider on system supported by citizenship of others.
  - Cheater is a free rider on system supported by honesty of others.

A rule of thumb

- Avoid action that undermines a practice it presupposes.
  - Cheating, practiced generally, undermines the grading system it presupposes.
  - Letting others do the voting, practiced generally, undermines the voting behavior it presupposes.

A rule of thumb

- But don’t be misled: it is OK to fight crime, even though if everyone did this, it would undermine the crime it seems to presuppose.
- One must look at the reasons for action.
  - The maxim might be, “Fight crime if crime exists.”
  - The existence of crime is a consistent rationale for fighting crime.
  - It does not presuppose that others will not fight crime if it exists.

Moral Agency

- Why must actions have reasons?
- Western worldview must distinguish action from mere behavior.
  - A mosquito's *behavior* is explained only by cause-and-effect and so is not *action*.
  - Human actions are *moral agents* when their behavior can *also* be plausibly explained as based on reasons.
  - This solves freedom & determinism dilemma.
- Ethics can be applied to complex robots, beings from another planet.

Moral Agency

- Unethical action is not action at all.
  - Has no coherent explanation in terms of reasons.
    - No consistent rationale explains my cheating on exam.
  - Behavior with only a “psychological” explanation is not action and therefore unethical.
    - I don’t vote because I am angry at the government.
    - I don’t vote because of some sublimated impulse, etc.
  - Unethical behavior destroys one’s agency and abdicates one’s freedom.

Rawlsian theory

- John Rawls characterized Kantian decision making as taking place behind a “veil of ignorance.”
  - People decide what to do without knowing who they are.
  - The reasons for the action must be valid regardless of the agent’s identity.
  - This is another way of stating that reasons for me must be reasons for anyone.

Rawlsian theory

- This is different from maximizing expected utility.
  - A CEO (deliberating behind the veil of ignorance) may approve a massive layoff because she is unlikely to be one of the redundant workers.
  - This is not good enough for Rawls.
  - She must find the reasons for the layoff equally valid if she herself is terminated.

Rawlsian theory

- Rawls infers a theory of distributive justice.
  - Policy makers must find their decisions to be justifiable even if they are in the lowest class.
  - Policy must never improve the lot of an upper class at the expense of a lower class.

Rawlsian theory

- According to Rawls, this results in a lexicographic criterion.
  - Act so as to maximize the welfare of the lowest class, then the second lowest class, etc.
- In general,

$$\text{lexmax} \quad f_1(x), \ldots, f_n(x)$$

$$\text{subject to} \quad x \in S$$

where $f_i(x)$ = utility of person with ith lowest utility.

Rawlsian theory

- Recall the distribution problem in which
  - x_i = resources allotted to person i.
  - $c_i x_i^p$ = utility created by allotment x_i, where $0 \leq p \leq 1$.
  - R = total resources available.
- In this simple case, the lexmax equalizes utility across the population.

Rawlsian theory

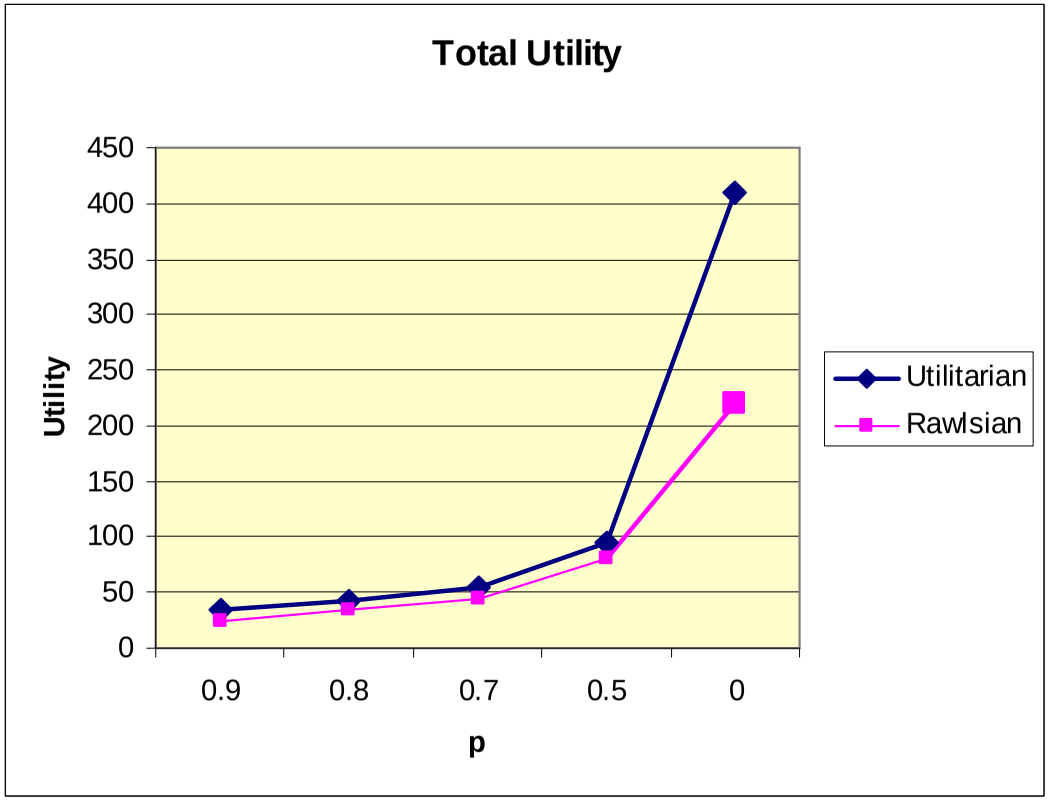
- The lexmax allocation of resources x_i and fraction u_i of utility is

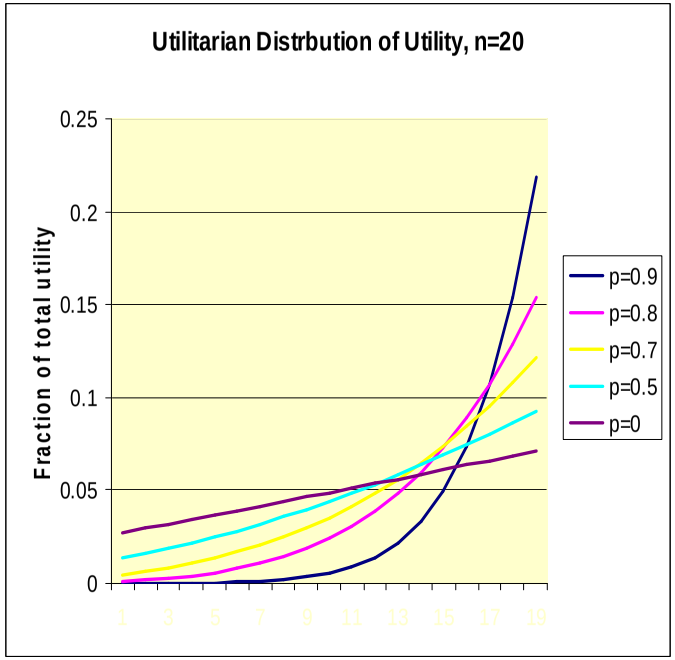
$$x_i = R\frac{c_i^{-1/p}}{\sum_j c_j^{-1/p}} \qquad u_i = \frac{1}{n}$$

- compared to the utilitarian solution

$$x_i = R\frac{c_i^{1/(1-p)}}{\sum_j c_j^{1/(1-p)}} \qquad u_i = \frac{c_i^{1/(1-p)}}{\sum_j c_j^{1/(1-p)}}$$

Rawlsian theory





Professional ethics

What is it?

What is a professional?

- A professional:
  - is an expert.
  - uses expertise responsibly.
  - professes.

Why have professions?

- Professionalism provides certification when expertise is not immediately obvious.
  - A cashier's incompetence is obvious at the end of the day.
  - An accountant's incompetence can do much damage before it becomes evident.
    - So we have an accounting profession, with certification.

Professional obligations

- Since professions exist to create expectations, a professional's obligation is to meet them.
- Professional obligations are questions of fact, not ethics.
  - What is expected?
  - What is consistent with the mission of the profession?

Professional obligations

- In engineering, expectations are often codified.
  - Engineering standards/handbooks.
  - Codes of ethics issued by professional societies.
  - ISO standards.
  - NIST standards.
  - ISA standards.

Professional obligations

- Key question: Should professionals make decisions or just present the options?
- Stockbroker, lawyer: Give advice but carry out the client's wishes.
- Physician, teacher, engineer: Use professional judgment even if contrary to client's wishes.
  - Decline to prescribe drug or perform surgery.
  - Teach unpopular material.
  - Resist cost savings that would make bridge unsafe.

Intellectual property

Legal aspects

Legal definition of IP

- Patent
- Trade secret
- Copyright
- International agreements

Patent

- Designed to encourage *disclosure* of ideas in exchange for limited period of exclusive use.
- Can patent:
  - A "method, product, apparatus, composition of matter, design for articles of commerce, or in certain cases a plant."
  - Software or an algorithm.
- Cannot patent:
  - A pure idea, such as a theorem.
  - Anything that occurs in nature.
  - A "way of doing business," even if automated by computer.
  - "Look and feel," e.g. spreadsheet.

Patent

- Patented invention must be useful, novel, and unobvious.
  - "Novel" means:
    - It was not known or used in the United States prior to the patent application.
    - It was not patented or described in a publication anywhere in the world more than a year prior to the patent application.
  - "Unobvious" means it was not obvious to a person skilled in the art at the time of the invention.

Patent

- Duration of patent is 20 years.
  - 14 years for “design for article of commerce” (ornamental appearance of device).

Trade secret

- It is a “secret formula, pattern, or device that is used in a business and provides a commercial advantage.”
  - It can be bought, sold and licensed.
- It remains intellectual property forever, or until the secret gets out.
  - For example, the formula for Coca-Cola.

Trade secret

- The law does not prohibit *use* of a trade secret.
  - It only prohibits others from *stealing* a trade secret.
- It is legal for another company to conceive the idea independently and use it.
  - Reverse engineering is not theft (the idea was not really secret).

Copyright

- It limits the number of copies others can make of a document or work of art without permission.
- It lasts longer than a patent.
  - Individual's copyright lasts 70 years beyond his or her lifetime (recently extended from 50).
    - Work made for hire: 95 years past publication or 120 years past creation, whichever is shorter.
- Ideas cannot be copyrighted.
  - Only a particular expression of ideas.

Ownership

- A patent is *registered* in the name of the inventor.
- The *owner* may be someone else, or a company.
  - An employer normally owns any idea conceived by someone working *for hire*.
    - The 3-M employee who invented post-it notes at home for his church choir had to turn rights over to the company.

Ownership

- Who works “for hire”?
  - Normally, full-time employees work for hire and do not retain IP rights.
    - However, a university faculty member normally retains rights to a scholarly article.
    - Universities are free to modify this tradition in the employment contract and sometimes do.
  - Normally, consultants do not work for hire, depending on contract.

Ownership

- A PhD student paid by professor to develop a specific algorithm is not working for hire.
  - Retains IP rights unless there is a specific agreement to the contrary.
  - **But**… professor or PhD student working under a grant is subject to terms of the grant.
  - A PhD student interested in IP rights should explore the issue *before* investing heavily in a project.
  - Universities typically publish IP policies.

International agreements

- The ruling international law is the TRIPS agreement.
  - Trade-Related Aspects of Intellectual Property Rights.
  - Added to GATT (General Agreement on Tariffs and Trade) at the Uruguay Round of trade negotiations in 1994.
  - Amended at 2001 WTO Ministerial Conference in Doha.

Intellectual property

Ethical aspects

Concept of IP

- The term *intellectual property* is only about 30 years old.
  - Can leave the impression that IP is like other property.
  - But one can use IP without denying others the use of it.
  - So it is unclear that IP rights are “natural” property rights analogous to the right to own an automobile or land.

Lockean defense for IP rights

- There is no property in a state of nature.
- But when humans improve or transform natural resources, they can *take possession* of the fruits of their labor.
  - Natural ownership of one's body extends to creations of one's body.
  - One can sell possessions once acquired.
  - So one can acquire property without creating it.

Lockean defense for IP rights

- But this is an argument for the right to *take possession* of something.
  - As opposed to leaving it available for common use.
  - But one cannot take possession if IP in this sense.
  - Lockean argument doesn't seem relevant to IP.

Kantian defense for IP rights

- One can act only if one has to freedom to choose one's actions.
  - This presupposes some degree of control over one's immediate surroundings.
  - To deny this kind of freedom is to deny agency and therefore immoral.

Kantian defense for IP rights

- One mechanism for ensuring control is the right to exclusive or at least uninterrupted use of artifacts one needs to carry out one's purposes.
  - So a right to a reasonable amount of property can be grounded in the right to agency.

Kantian defense for IP rights

- But one doesn't need exclusive use of IP, since others can use it simultaneously.
  - One can have full access to IP no matter how many other people use it.
  - So Kantian argument does not apply to IP.

Utilitarian defense for IP

- None of the previous says that there is no right to IP.
  - Only that there is no *natural* right.
- There may be a utilitarian obligation to respect IP rights.
  - This is a weaker right, as reflected in the law.
    - Limit on how long one can own IP.
    - Fewer limits on who can use it (trade secrets).

Utilitarian defense of IP rights

- Utilitarian argument for IP
  - IP rights provide incentive to develop new ideas.
    - This increases overall utility.
  - Patent law allows free discussion and exchange of ideas, despite IP rights.
    - Original intent of patent law.
    - Also increases utility.
      - But trade secrets, nondisclosure agreements restrict discussion.

Utilitarian defense of IP rights

- So IP rights are not rights to exclusive use of IP, but rights to make a profit from it.
- Unlike inherent human rights, all IP rights must be justified in terms of consequences to society.
  - There can be no “balancing” of IP and human rights.

Back to TRIPS agreement

- Some have criticized TRIPS agreement for trying to balance human and IP rights rather than giving human rights priority.
  - For example, restriction on compulsory licenses.
  - A major issue in pharmaceutical industry.

TRIPS agreement

- A state may issue a compulsory license to require a holders of a pharmaceutical patent to grant rights to the state or third party.
  - In exchange for royalties set by the state.
  - TRIPS agreement limits grounds for compulsory licenses to national emergencies and the like.

TRIPS agreement

- Doha amendments give countries the right to determine the grounds on which they grant compulsory licenses.
  - GATT signatories have taken little action to implement Doha reforms.

Moral status of IP

- Traditional conception of property rights was more sophisticated than the modern one.
  - Several kinds of property.
  - Only partially interchangeable.
  - For example, bride price may be payable only in cattle.

Moral status of IP

- Modern conception of property makes all assets interchangeable.
  - Reduction of all value to single medium of exchange.
  - This tends to result in concentration of wealth
    - One can use economic power to acquire assets of those less well off. (See M. Walzer, *Spheres of Justice*).

Future of IP rights

- But we are seeing a trend away from this extreme solution.
  - Illegality of prostitution.
  - Abolition of chattel slavery.
  - Removal of medical care from marketplace in some countries.

Future of IP rights

- Strengthening of IP goes against this trend.
  - Further extends interchangeability of assets.
    - Response to business pressure over the last century.
    - Minor modifications of life forms can be patented.
      - *Diamond v. Chakrabarty*
    - Minor modifications of folk knowledge can be patented.
      - W. R. Grace and Neemix.
  - IP is the chattel slavery of our age?

Future of IP rights

- Incentives for innovation are key to West's continued prosperity in a new world order.
  - "Developed" and "less developed" nations therefore clash over IP agreements.

Future of IP rights

- We may see a weakening of IP rights, due to:
  - Growing clout of non-Western nations.
  - General trend away from reducibility of value.
  - Growing practicality of limits on interchangeability.
    - Airline miles.
    - Web-based accounting.