Act Utilitarianism

Inputs: Utility/measure of happiness

How to calculate: For each option, sum up each user's happiness with it, and the option with the highest happiness is the best output.

Eg. best outcome = arg max(total happiness for preference 1, total happiness for preference 2, … preference n)

Scenario: Deciding the Best Action（例如选择哪种食物，选择去哪旅游等）. 此准则通常适用于考虑到多个用户的幸福值做出决定。 幸福值代表用户对不同行为感到幸福的程度。当用户都有自己的偏好选择时，通过计算最高的幸福值得到最佳选项。例如，用户1对选项A的幸福值为7，对选项B的幸福值为4；用户2对A和B分别为3和8，则A的总幸福值为7+3=10，B的为4+8=12，因此B为最佳选项。

Prioritarianism/Maximin

Inputs: Utility/measure of happiness

How to calculate: Compare the lowest user happiness among each option, and the option with the highest value among these lowest happiness is the best output.

Eg. best outcome =arg max(min(each user happiness for preference 1), min(…preference 2),…min(preference n))

Scenario: Deciding the Best Action（例如选择哪种食物，选择去哪旅游等）.此准则适用于偏向效用较低的弱势群体而做出决定。当用户都有自己的偏好选择时，Compare the lowest user happiness among each option, and the option with the highest value among these lowest happiness is the best output. 例如，用户1对选项A的幸福值为7，对选项B的幸福值为4；用户2对A和B分别为3和8，则A的幸福值分别为7和3，其中最低为3，B的为4和8，其中最低为4，比较A和B的最低值3和4，因此B为最佳选项。

Envy-Freeness ?

Resource allocation ensures that no one has envy.

Eg. Allocate chocolate pieces

Doctrine of Double Effect ?

The Doctrine of Double Effect typically includes four conditions that must be met for an action to be morally permissible:

1. The action must be morally good or at least morally neutral in itself.
2. The bad effect must not be intended, but only foreseen or anticipated.
3. The good effect must be intended.
4. The good effect must outweigh the bad effect

Eg. The doctor injected a pain reliever into a patient with advanced cancer.

Doctrine of Disparate Impact ?

The results, which appear neutral on the surface, actually have a disproportionately negative impact.

Do No Harm ?

This principle reflects the idea that preventing harm to others is often more important than achieving positive results. This principle reflects the idea that preventing harm to others is often more important than achieving positive results.

Libertarian Proportionalism

Inputs: Contribution

How to calculate: The option with the highest contribution ratio is the best output.

Eg. best outcome = arg max(each user’s contribution to each preference)

Scenario: Deciding the Best Action. 当用户都有自己的偏好选择时，the option with the highest contribution value is the best output. 贡献值代表用户为不同行为愿意付出的程度。例如，用户1对选项A的贡献值为7，对选项B的贡献值为4；用户2对A和B分别为3和6，通过比较这些贡献值，用户1愿意贡献最多，最高值为7，因此A为最佳选项

Desert-Based Proportionalism

Inputs: Contribution/Luck

How to calculate: The option with more contribution and less luck will be the best output.

Eg. best outcome = arg max(contribution-luck)

Scenario: Deciding the Best Action. 当用户都有自己的偏好选择时，The option with more contribution and less luck will be the best output. 例如，用户1对选项A的贡献值为7，对选项B的贡献值为4；用户2对A和B分别为3和6，

Luck Egalitarianism

Inputs: Luck

How to calculate: The option with the lowest luck value is the best output. OR allocate more resources to less luck weight user to reach equal distribution.

E.g. A = 8 luck; B= 2 luck; Resources = 10

Discount for the effects of luck =

total luck is 10

B has 20% luck and A has 80% luck

Flip this to get weightings (i.e. discounting for the effects of luck) so B has 80% weighting and A has 20% weighting

Equal distribution = 1% of resource for each 1% weighting

Thus, distribute so B gets 8 resources and A gets 2 resources

QUESTION：focus on one purpose and allocate resources? Why hard to choose the best preference and why other egalitarianism principles seemed reasonable? How to decide which principle would be used?

Autonomy Egalitarianism

Inputs: Autonomy

How to calculate: Choose the outcome with the most equal distribution of autonomy between users. If the distribution for each preference is the same, choose the highest autonomy.

Eg. best outcome = arg min(the difference of autonomy between users for each preference), if no minimum difference, arg max(autonomy for each preference)

Non-Maleficence Egalitarianism

Inputs: Harms

How to calculate: Choose the outcome with the most equal distribution of harms between users. If the distribution is the same, choose the lowest harm.

Eg. best outcome = arg min(the difference of harms between users for each preference), if no minimum difference, arg min(harm for each preference)

Equality of Opportunity

Inputs: Opportunity

How to calculate: Choose the outcome with the most equal distribution of opportunities between users. If the distribution is the same, choose the most opportunity.

Eg. best outcome = arg min(the difference of opportunity between users for each preference), if no minimum difference, arg max(opportunity for each preference)

**Table1: The Inputs of Ethics Principles**

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| **Inputs** | **Definition** | **Applicable Principles** |
| Utility/Happiness | The degree to which users prefer or feel good about an action or resources. | Utilitarianism,  Prioritarianism |
| Contribution | The value that users contribute to an action or resources. | Libertarian Proportionalism,  Desert-Based Proportionalism |
| Luck | The higher value means luckier and more successful. Luck refers to events or factors that a person has no personal control over, such as genetics, family background, economic circumstances, etc. | Luck Egalitarianism,  Desert-Based Proportionalism |
| Autonomy | The higher autonomy value refers to the more freedom that people have in making decisions and choices. | Autonomy Egalitarianism |
| Harm | A higher harm value means that the action or decision has a greater risk of causing harm to someone. | Non-Maleficence Egalitarianism |
| Opportunity | The higher the opportunity value means users enjoy the greater the chance to have the resources or decision. | Equality of Opportunity |

**Table2: Ethics Principles and their Scenarios**

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| **Ethics Principles** | **Main Idea** | **Applicable Scenarios** |
| Utilitarianism | Consider the utility or happiness of users as a measure of morality. Maximizing the total utility is the best output. | Deciding the Best Action  Allocating resources? |
| Prioritarianism | Consider the disadvantaged groups with lower utility/happiness as the priority. | Deciding the Best Action,  Allocating resources |
| Libertarian Proportionalism | Consider the contribution of users to an object as a measure of morality. | Deciding the Best Action,  Allocating resources |
| Desert-Based Proportionalism | Consider the contribution of users and their luck as measures of morality. | Deciding the Best Action,  Allocating resources |
| Luck Egalitarianism | Consider the disadvantaged groups with worse luck as the priority and discount for the effects of luck. | Allocating resources |
| Autonomy Egalitarianism | Consider each user can equally exercise more autonomy and freedom. | Deciding the Best Action,  Allocating resources |
| Non-Maleficence Egalitarianism | Consider getting less harms which are equally distributed. | Deciding the Best Action,  Allocating resources |
| Equality of Opportunity | Consider getting more opportunities which are equally distributed. | Deciding the Best Action,  Allocating resources |

**Table3: Principles that are applicable in Deciding the Best Action Examples**

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| **Ethics Principles** | **How to Calculate** | **Example** |
| Utilitarianism | For each option, sum up each user's utility/happiness with it, and the option with the highest happiness is the best output. | User X’s Happiness: option A=7, option B= 4, User Y’s Happiness: A=3, B=8. Total happiness value of A=7+3=10, B=4+8=12. So B is the best option. |
| Prioritarianism | Compare the lowest user happiness among each option, and the option with the highest value among these lowest happiness is the best output. | User X’s Happiness: option A=7, option B= 4, User Y’s Happiness: A=3, B=8. A has 7,3 where the lowest is 3. B has 4,8 where the lowest is 4. Compare the lowest value 4>3. So B is the best option. |
| Envy-Freeness | For each option, sum up each user's envy with it, and the option with the highest happiness is the best output.  Choose the outcome with the minimum mean value of envy among users. If some mean values are the same, choose the action with highest autonomy. | User X’s Envy: option A=0, option B= 8, User Y’s Autonomy: A=6, B=0. Calculate each option’s mean Envy between each user: A: , B: . The minimum value means the degree of Envy for this option is lowest. So, A is the best option. |
| Libertarian Proportionalism | The option with the highest contribution value is the best output. | User X’s Contribution: option A=7, option B= 4, User Y’s Contribution: A=3, B=6. By comparing these contribution values, 7>6>4>3, user X is willing to contribute A most. So A is the best option. |
| Desert-Based Proportionalism | The option with more contribution and less luck will be the best output. | User X’s Contribution: option A=7, option B= 4, User Y’s Contribution: A=3, B=6. User X’s Luck = 6, User Y’s Luck = 3. Calculate Contribution-Luck for User X: A: 7-6 = 1, B: 4-6 = -2. Calculate Contribution-Luck for User Y: A: 3-3 = 0, B: 6-3= 3. Find their max difference = 3>1>0>-2  So B is the best option |
| Autonomy Egalitarianism | Choose the outcome with the minimum standard deviation of autonomy among users. If some std are the same, choose the action with highest autonomy. | User X’s Autonomy: option A=7, option B= 4, User Y’s Autonomy: A=6, B=4. Calculate each option’s autonomy Abs Difference between each user: A: 7-6=1, B: 4-4=0. The minimum value means the most equal distribution. So B is the best option. |
| Non-Maleficence Egalitarianism | Choose the outcome with the minimum standard deviation of harm among users. If some std are the same, choose the action with lowest harm. | User X’s Harm: option A=5, option B= 4, User Y’s Harm: A=5, B=4. Calculate each option’s Harm Abs Difference between each user: A: 5-5=0, B: 4-4=0. Their Abs Difference are the same, so choose the lowest harm = 4 < 5. So B is the best option. |
| Equality of Opportunity | Choose the outcome with the minimum standard deviation of opportunity among users. If some std are the same, choose the action with highest opportunity. | User X’s Opportunity: option A=5, option B= 4, User Y’s Opportunity: A=4, B=3. Calculate each option’s autonomy Abs Difference between each user:  A: 5-4=1, B: 4-3=1. Their Abs Difference are the same, so choose the most Opportunity = 5 > 4 > 3. So A is the best option. |

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| **Ethics Principles** | **How to Calculate** | **Example** |
| Utilitarianism | For limited resources, allocate resources proportionally according to the utility/happiness of the users. | Total Resources = 13  User X’s Happiness when get 1 resource = 6  User Y’s Happiness = 7  User X get  User Y get |
| Envy-Freeness |  |  |
| Prioritarianism | For limited resources, calculate the utility/happiness proportions of users and flip them as the weight of allocating resources. | Total Resources = 13  User X’s Happiness without resources = 6  User Y’s Happiness = 7  User X’s Happiness Proportion =  User Y’s Happiness Proportion =  Flip them, get their resources weight:  User X weight =  User Y weight =  So, user X get  user Y get |
| Libertarian Proportionalism | For limited resources, allocate resources proportionally according to the contribution of the users. | Total Resources = 13  User X’s Contribution = 6  User Y’s Contribution = 7  User X get  User Y get |
| Desert-Based Proportionalism | Calculate the value of contribution – luck for each user. Then allocate resources proportionally according to the difference. | Total Resources = 12  User X’s Contribution = 6  User Y’s Contribution = 7  User X’s Luck = 4  User Y’s Luck = 6  Calculate Contribution-Luck for User X: 6-4 = 2  Calculate Contribution-Luck for User Y: 7-6 = 1  User X get  User Y get |
| Luck Egalitarianism | For limited resources, calculate the luck value proportions of users and flip them as the weight of allocating resources. | Total Resources = 13  User X’s Luck = 6  User Y’s Luck = 7  User X’s Luck Proportion =  User Y’s Luck Proportion =  Flip them, get their resources weight:  User X weight =  User Y weight =  So, user X get  user Y get |
| Autonomy Egalitarianism | For limited resources, allocate resources proportionally according to the Autonomy of the users. | Total Resources = 13  User X’s Autonomy = 6  User Y’s Autonomy = 7  User X get  User Y get |
| Non-Maleficence Egalitarianism | For limited resources, calculate the Harm value proportions of users and flip them as the weight of allocating resources. | Total Resources = 13  User X’s Harm = 6  User Y’s Harm = 7  User X’s Harm Proportion =  User Y’s Harm Proportion =  Flip them, get their resources weight:  User X weight =  User Y weight =  So, user X get  user Y get |
| Equality of Opportunity | For limited resources, allocate resources proportionally according to the Opportunity of the users. | Total Resources = 13  User X’s Opportunity = 6  User Y’s Opportunity = 7  User X get  User Y get |

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| **Inputs** | **Decide the Best Way/ Product/Place of Consumption (about spending money)** | **Decide the Best Behaviour (about taking an action)** |
| Utility/Happiness | Representing the degree to which each person feels happy with different consumptions.  E.g.  A user has happiness = 6 for KFC and 3 for McDonald's. | Representing the degree to which each person feels happy with different behaviours.  E.g.  A user has happiness = 6 for driving to work and 3 for public transport. |
| Contribution | Representing the extent to which each person is willing to pay for different consumptions.  E.g.  A user is willing to contribute = 6 (60%) for food from KFC and 3 (30%) for McDonald's. | Representing the extent to which each person is willing to contribute for different behaviours.  E.g.  A user is willing to contribute = 8 (80%) for cleaning the house, and 1 (10%) for cooking. |
| Luck | Representing the financial situation of each person.  E.g.  User A is in a bad financial situation and has a Luck = 3, and would like to go to a cheaper fast food restaurant. User B is in a good financial situation, with a Luck=7, and wants to go to an upscale restaurant. | This represents the situation of each person.  E.g.  User A is blind, has Luck = 1 and wants to go to a library further away that could support for the blind. User B is a general person with Luck = 7 and wants to go to a library nearer but has no available books for the blind. |
| Autonomy | Each person has the freedom of choice for different consumptions.  E.g.  A user likes chicken and dislikes beef. KFC has more chicken and less beef, while McDonald has the opposite. So the user's Autonomy is 8 for KFC and for McDonald it is 3. | Representing the degree of freedom each person has for different behaviours.  E.g.  A user likes science fiction. Library A has more science fiction and Library B has less. Therefore, the Autonomy for Library A is 8 and for Library B is 3. |
| Harm | Harm is opposite of Happiness.  Harm indicates the degree to which each person feels unpleasant about different consumptions.  E.g.  A user dislike KFC with a weight Harm = 3, and 6 for McDonald. | Representing possible risks or harms for each person for different behaviours.  E.g.  A user is good at skiing but not at skating. Therefore, the harm for skiing is 2 and for skating is 8. |
| Opportunity | Opportunity indicates how many choices each person has for different consumptions.  It is similar to Autonomy. | Representing the extent of having options for each person for different behaviours.  E.g.  A user applies for a university major. University A has more options for major than University B. Then the user has Opportunity = 7 for University A and 5 for B. |

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| **Inputs** | **Allocate Limited Resources** | **Decide the Best Behaviour (about taking an action)** |
| Utility/Happiness | Represents each user’s level of usefulness or satisfaction with resources.  E.g.  User A has happiness = 6 when getting Water Resources and User B has happiness = 8.  Therefore, water resources will be allocated more to User A (people have more Happiness). | Representing the degree to which each person feels happy with different behaviours.  E.g.  A user has happiness = 6 for driving to work and 3 for public transport. |
| Contribution | Representing the extent to which each person is willing to pay for resources.  E.g.  User A is willing to contribute = 6 (60%) for coal resources. While User B is willing to contribute = 3 (30%).  Therefore, coal resources will be allocated more to User A (people who contribute/pay more). | Representing the extent to which each person is willing to contribute for different behaviours.  E.g.  A user is willing to contribute = 8 (80%) for cleaning the house, and 1 (10%) for cooking. |
| Luck | Representing personal situation that each person cannot control over.  E.g.  User A is in a bad financial situation and has a Luck = 1, and User B is in a good financial situation, with a Luck=7.  Therefore, healthcare resources will be allocated more to User A (people in poorer areas). | This represents the situation of each person.  E.g.  User A is blind, has Luck = 1 and wants to go to a library further away that could support for the blind. User B is a general person with Luck = 7 and wants to go to a library nearer but has no available books for the blind. |
| Autonomy | Representing the autonomy of each user for resources.  E.g.  User A and User B want access to infrastructure resources to build their own companies.  User A's freedom to build with these resources, i.e. Autonomy = 6, is greater than User B's Autonomy = 5.  Thus User A has access to more resources (people has more autonomy). | Representing the degree of freedom each person has for different behaviours.  E.g.  A user likes science fiction. Library A has more science fiction and Library B has less. Therefore, the Autonomy for Library A is 8 and for Library B is 3. |
| Harm | Harm is opposite of Happiness.  Harm indicates the degree to which each person feels unpleasant or gets harm with resources.  E.g.  User A is allergic if he eats too many mangoes and has a harm = 6 for mangoes, while User B is not allergic and has a harm = 1.  Therefore, when a batch of mangoes is allocated, more are allocated to User B (the user who suffers less harm). | Representing possible risks or harms for each person for different behaviours.  E.g.  A user is good at skiing but not at skating. Therefore, the harm for skiing is 2 and for skating is 8. |
| Opportunity | Representing the possibilities/opportunities for each person to access resources.  E.g.  User A and User B apply to the leader for human resources. User A completes more tasks than User B and is more favoured by the leader.  Therefore, User A has a better opportunity = 7 to obtain more resources than User B that opportunity = 5. | Representing the extent of having options for each person for different behaviours.  E.g.  A user applies for a university major. University A has more options for major than University B. Then the user has Opportunity = 7 for University A and 5 for B. |

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| **Ethics Principles** | **Definition** | **Reason that Excludes** |
| Virtue Ethics | 正确的行为是由具有美德品格的人执行的 | 个体的性格品格作为因素很难以定量形式输入 |
| Kantian | 将他人视为达到目的的手段是不道德的 | 个体的意图作为因素很难以定量形式输入。适合判断行为的道德性。不适用于分配资源和最佳决策情景。 |
| Doctrine of Double Effect | 故意造成伤害是错误的，即使结果是积极的。如果意图是积极的，结果造成了一定伤害也是可以接受的。 | 多种因素例如意图和行为的结果很难为定量数据。需要更复杂的分析行为后果模型。 |
| Disparate Impact Doctrine | 任何群体应该有相等或成比例结果影响分配。 | 影响的概念很抽象。需要更复杂的分析行为后果模型。 |
| Do No Harm | 任何能造成伤害的行为都是不正确的 | 适合判断行为的道德性。不适用于分配资源和最佳决策情景。 |