hw3_games_q11_preferences_and_utilities

Question 11: Preferences and Utilities

0.0/2.0 points (graded)

Our Pacman board now has food pellets of 3 different sizes - pellet P_1 of radius 1, P_2 of radius 2 and P_3 of radius 3. In different moods, Pacman has different preferences among these pellets. In each of the following questions, you are given Pacman's preference for the different pellets. From among the options pick the utility functions that are consistent with Pacman's preferences, where each utility function $U(r)$ is given as a function of the pellet radius r, and is defined over non-negative values of r.

$P_1 \sim P_2 \sim P_3$

- [x] $U(r) = 0$ ✔
- [x] $U(r) = 3$ ✔
- [ ] $U(r) = r$
- [ ] $U(r) = 2r + 4$
- [ ] $U(r) = -r$
- [ ] $U(r) = r^2$
- [ ] $U(r) = -r^2$
- [ ] $U(r) = \sqrt{r}$

- [ ] $U(r) = -\sqrt{r}$
- [ ] Irrational preferences!

Because all three sizes are preferred equally, U(r) has to return the same value for r=1,2,3. The only functions that do so are those that do not depend on r.

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Answers are displayed within the problem

problem

0.0/2.0 points (graded)

$P_1 \prec P_2 \prec P_3$

- [ ] $U(r) = 0$
- [ ] $U(r) = 3$
- [x] $U(r) = r$ ✔
- [x] $U(r) = 2r + 4$ ✔
- [ ] $U(r) = -r$
- [x] $U(r) = r^2$ ✔
- [ ] $U(r) = -r^2$
- [x] $U(r) = \sqrt{r}$ ✔

- [ ] $U(r) = -\sqrt{r}$
- [ ] Irrational preferences!

Higher radii are preferred over lower ones, so increasing functions of r satisfy the constraints.

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problem

0.0/2.0 points (graded)

$P_1 \succ P_2 \succ P_3$

- [ ] $U(r) = 0$
- [ ] $U(r) = 3$
- [ ] $U(r) = r$
- [ ] $U(r) = 2r + 4$
- [x] $U(r) = -r$ ✔
- [ ] $U(r) = r^2$
- [x] $U(r) = -r^2$ ✔
- [ ] $U(r) = \sqrt{r}$

- [x] $U(r) = -\sqrt{r}$ ✔

- [ ] Irrational preferences!

Lower radii are preferred over higher ones, so decreasing functions of r satisfy the constraints.

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problem

0.0/2.0 points (graded)

$(P_1 \prec P_2 \prec P_3)$ **and** $(P_2 \prec (\text{ 50-50 lottery among } P_1 \text{ and } P_3))$

- [ ] $U(r) = 0$
- [ ] $U(r) = 3$
- [ ] $U(r) = r$
- [ ] $U(r) = 2r + 4$
- [ ] $U(r) = -r$
- [x] $U(r) = r^2$ ✔
- [ ] $U(r) = -r^2$
- [ ] $U(r) = \sqrt{r}$

- [ ] $U(r) = -\sqrt{r}$
- [ ] Irrational preferences!

The first constraint means that $U(r)$ must be increasing, and the second constraint means that the rate at which it is increasing must be increasing as well, and r^2 is the only function that is of the ones provided.

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problem

0.0/2.0 points (graded)

$(P_1 \succ P_2 \succ P_3)$ and $(P_2 \succ (\text{ 50-50 lottery among } P_1 \text{ and } P_3))$

- [ ] $U(r) = 0$
- [ ] $U(r) = 3$
- [ ] $U(r) = r$
- [ ] $U(r) = 2r + 4$
- [ ] $U(r) = -r$
- [ ] $U(r) = r^2$
- [x] $U(r) = -r^2$ ✔
- [ ] $U(r) = \sqrt{r}$

- [ ] $U(r) = -\sqrt{r}$

- [ ] Irrational preferences!

The first constraint means that U(r) must be decreasing, and the second constraint means that the rate at which it is decreasing must be decreasing as well.

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problem

0.0/2.0 points (graded)

$(P_1 \prec P_2)$ and $(P_2 \prec P_3)$ and
$(($ 50-50 lottery among P_2 and $P_3) \prec ($ 50-50 lottery among P_1 and $P_2))$

- [ ] $U(r) = 0$
- [ ] $U(r) = 3$
- [ ] $U(r) = r$
- [ ] $U(r) = 2r + 4$
- [ ] $U(r) = -r$
- [ ] $U(r) = r^2$
- [ ] $U(r) = -r^2$
- [ ] $U(r) = \sqrt{r}$

- [ ] $U(r) = -\sqrt{r}$

- [x] Irrational preferences! ✔

$P_3 \succ P_1$ by transitivity, and since both lotteries have equal chances for P_2, it can be ignored when comparing the two. So the last constraint is essentially $P_3 \prec P_1$, which makes the preferences irrational.

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problem

0.0/2.0 points (graded)

Which of the following would be a utility function for a risk-seeking preference? That is, for which utility(s) would Pacman prefer entering a lottery for a random food pellet, with expected size s, over receiving a pellet of size s?

- [ ] $U(r) = 0$
- [ ] $U(r) = 3$
- [ ] $U(r) = r$
- [ ] $U(r) = 2r + 4$
- [ ] $U(r) = -r$
- [x] $U(r) = r^2$ ✔
- [ ] $U(r) = -r^2$

- [ ] $U(r) = \sqrt{r}$
- [x] $U(r) = -\sqrt{r}$ ✔

Functions that are either decreasing slower than linearly, like $-\sqrt{r}$, or increasing faster than linearly, like r^2, satisfy this.

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Answers are displayed within the problem