Let's evaluate each criterion step-by-step to help John decide on his best action.

让我们逐步评估每个标准，以帮助约翰决定最佳行动。

Given Data给定数据

	S1	S2	S3
C1 (Renovate)	50	-110	130
C2 (Do nothing)C2（什么都不做）	170	-70	100
C3 (Sell)	-60	50	-20

Solution

(a) Criterion of Pessimism (Maximin Criterion)(a) 悲观主义准则（最大最小准则）

In the pessimism criterion, John will choose the action that maximizes the minimum payoff (assuming the worst-case scenario in each action). We will take the minimum payoff of each action and choose the action with the highest minimum payoff.

在悲观标准中，约翰将选择使最小收益最大化的行动（假设每个行动中最坏的情况）。我们将取每个动作的最小收益，并选择具有最高最小收益的动作。

- **C1 (Renovate)**: minimum = -110
- **C2 (Do nothing)**: minimum = -70**C2（不执行任何操作）**：最小值 = -70
- **C3 (Sell)**: minimum = -60

Maximin decision: The highest minimum payoff is -60, so **John should choose C3 (Sell)**.

最大最小决策：最高最低收益为-60，因此**约翰应该选择 C3（卖出）**。

(b) Criterion of Optimism (Maximax Criterion)(b) 乐观准则（Maximax Criterion）

In the optimism criterion, John will choose the action with the maximum possible payoff (assuming the best-case scenario in each action).

在乐观标准中，约翰将选择具有最大可能回报的行动（假设每个行动的最佳情况）。

- **C1 (Renovate)**: maximum = 130
- **C2 (Do nothing)**: maximum = 170**C2（不执行任何操作）**：最大值 = 170
- **C3 (Sell)**: maximum = 50

Maximax decision: The highest maximum payoff is 170, so **John should choose C2 (Do nothing)**.**Maximax决策：**最高的最大收益是170，所以**John应该选择C2（什么也不做）**。

(c) Criterion of Regret (Minimax Regret Criterion)(c) 遗憾标准（最小最大遗憾标准）

The regret (or opportunity loss) for each action is calculated by comparing each outcome with the best outcome for each scenario. We then choose the action with the smallest maximum regret.

每个行动的遗憾（或机会损失）是通过将每个结果与每个场景的最佳结果进行比较来计算的。然后我们选择最大遗憾最小的动作。

1. **Calculate the regret table:计算后悔表：**
   - **For S1**: Best outcome = 170 (C2)
   - **For S2**: Best outcome = 50 (C3)
   - **For S3**: Best outcome = 130 (C1)

	S1 Regret	S2 Regret	S3 Regret
C1 (Renovate)	120	160	0
C2 (Do nothing)C2（什么都不做）	0	120	30
C3 (Sell)	230	0	150

2. **Calculate the maximum regret for each action:计算每个动作的最大遗憾：**
   - **C1 (Renovate)**: max regret = 160
   - **C2 (Do nothing)**: max regret = 120**C2（什么都不做）**：最大后悔= 120
   - **C3 (Sell)**: max regret = 230

Minimax Regret decision: The smallest maximum regret is 120, so **John should choose C2 (Do nothing)**.

Minimax Regret决策：最小的最大后悔是120，所以**John应该选择C2（什么都不做）**。

(d) Hurwicz Criterion (with coefficient of optimism p)(d) Hurwicz 准则（乐观系数 p ）

The Hurwicz criterion is a weighted average of the best and worst outcomes for each action, using the coefficient of optimism p (where $0 \leq p \leq 1$).

Hurwicz 标准是使用乐观系数对每个行动的最佳和最差结果进行加权平均 p （在哪里 $0 \leq p \leq 1$ ）。

For each action C: $H(C) = p \times (\text{maximum payoff}) + (1-p) \times (\text{minimum payoff})$

对于每个动作 C ： $H(C) = p \times (\text{maximum payoff}) + (1-p) \times (\text{minimum payoff})$

Let's calculate the Hurwicz criterion for each action in terms of p.

让我们计算每个动作的 Hurwicz 标准： p 。

1. **C1 (Renovate):** $H(C1) = p \times 130 + (1-p) \times (-110)$ $H(C1) = 130p - 110 + 110p$ $H(C1) = 240p - 110$
2. **C2 (Do nothing):** $H(C2) = p \times 170 + (1-p) \times (-70)$ $H(C2) = 170p - 70 + 70p$ $H(C2) = 240p - 70$

   C2（什么都不做）： $H(C2) = p \times 170 + (1-p) \times (-70)$ $H(C2) = 170p - 70 + 70p$ $H(C2) = 240p - 70$
3. **C3 (Sell):** $H(C3) = p \times 50 + (1-p) \times (-60)$ $H(C3) = 50p - 60 + 60p$ $H(C3) = 110p - 60$

Now, we need to find the ranges of p for which each action has the highest H-value.

现在，我们需要找到范围 p 每个动作都有最高的 H -价值。

- For **C1** to be optimal: $240p - 110 \geq 240p - 70$ and $240p - 110 \geq 110p - 60$.

  为了使**C1**最优： $240p - 110 \geq 240p - 70$ 和 $240p - 110 \geq 110p - 60$ 。
  - Comparing with C2: $-110 \geq -70$ → **Never optimal for any p**

    与C2比较： $-110 \geq -70$ **→对于任何 p 都不是最佳的**
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