**Full Decision Tree Interpretation**

**1. Root Split: Opening Price (Most Important Factor)**

* **Split:** open price in USD <= 3.675

**2. Left Subtree (Low Opening Price)**

* **I**f close price in USD <= 3.675:
  + Check open price in USD <= 0.845:
    - ≤ 0.845 → 66% classified as competitive
    - > 0.845 → mostly non-competitive, with ~80% classified as non-competitive
* **If** close price in USD > 3.675:
  + All competitive (0 non-competitive vs 388 competitive)

**3. Right Subtree (High Opening Price)**

* **If** close price in USD <= 4.87:
  + mostly non-competitive, with 82% classified as non-competitive
* **If** close price in USD > 10:
  + Further split:
    - Open price in USD <= 10.044: mostly competitive (~86.3% competitive)
    - Open price in USD > 10.044: mixed, but several branches remain mostly non-competitive

**Obvious Findings**

1. Low opening price drives competitiveness. Auctions that start cheap attract more bidders.
2. High opening price discourages competition. Most high-start auctions end up noncompetitive.

**Unexpected Findings**

1. Seller reputation matters only in special cases. Among auctions with both high opening and closing prices, lower seller ratings (≤ 562) were actually more likely to be competitive.
2. Duration, end day, currency, and category barely show up in the splits.
3. Not all low-start auctions are competitive. Some low open/close auctions still ended non-competitive, possibly for undesirable items/categories.
4. High close price isn’t always competitive. At high opening prices, many auctions remain noncompetitive even if the close price is high, suggesting one serious buyer rather than multiple bidders.

**Which variable to drop. Is this model practical for predicting the outcome of a new auction?**

We drop **close price** and keep **opening price, duration, seller rating, currency, and category** as predictors. The reason is that sellers can’t control the closing price, so including it does not provide any actionable insights on how to make their auctions more competitive. Furthermore, splitting on close price is computationally burdensome. Therefore, it is reasonable and practical to exclude it from the model.

**For practical tree:**

**Provide and interpret the classification table.**

**Model performance**

* The model is reasonably balanced: it predicts competitive auctions slightly better than non-competitive ones.
* F1-scores are fairly close for both classes (0.675 vs 0.723), suggesting no extreme bias.

**Practical implications**

* **70.1% accuracy** — the model can give sellers a useful estimate, but it’s not perfect.
* The slightly higher precision/recall for competitive auctions is favorable if the goal is to **identify auctions likely to attract multiple bids.**

**Limitations**

* About **29.9% of auctions are misclassified**, so the model should be used as a guide rather than a guarantee.

**Conclusion**

* The model is **practical for predicting new auctions** using only features sellers can control (opening price, duration, rating, currency, category).
* Sellers can use it to adjust auction settings to increase the chance of competitiveness, but they should be aware that predictions are not perfect.

**Based on this last tree, what can you conclude from these data about the chances of an auction obtaining at least two bids and its relationship to the auction settings set by the seller (duration, opening price, ending day, currency)?**

Out of 1,972 auctions in the dataset, **1,066 were competitive** (**54% competitive)**.

* **Opening price:** A lower opening price strongly increases the likelihood of a competitive auction, as it encourages more initial bidding activity.
* **Seller reputation:** Higher seller ratings are associated with greater competitiveness, holding price constant.

**Auction settings:**

* **Duration:** Five-day auctions showed slightly higher competitiveness compared to other durations.
* **Category:** Some categories, such as music, movieand **game,** appeared more competitive; however, their small sample sizes need cautious interpretation.
* **Based on the exploratory data analysis, auctions ending on Monday or Thursday tended to be more competitive than those ending on weekends, though this may vary by product category. Listings in GBP or EUR also showed slightly higher competitiveness, possibly reflecting differences in market segments and geographic factors. These insights should be applied with caution, as the sample sizes across categories vary a lot, and the decision tree did not identify ending day or currency as key predictors of competitiveness.**

**What would you recommend for a seller as the strategy that will most likely lead to a competitive auction?**

* **Set a lower opening price to attract early bidders and generate competitive momentum.**
* **Leverage seller reputation: maintain strong ratings and highlight credibility. New sellers should consider strategies to build positive feedback early.**
* **Optimize auction duration and timing: 5–7-day listings tend to perform well. 8-10-day auctions show slightly lower competitiveness. Avoid low activity ending times and consider ending auctions on Monday or Thursday.**
* **Account for category difference: adjust pricing strategies according to category-specific demand patterns and competitor pricing behavior.**