1. Looking at Exhibit 4, which ship is (or ships are) the best reference transaction(s), that is the closest comparable(s)? How much is the Bet Performer worth based on comparable transactions (no regression needed here)?

Bet Performer was built in 1997 and was a 172,000 DWT capesize bulk carrier. Considering the year built, the type and the size of Bet Performer, Fertilia is the closest comparable. Based on comparable transaction, the Bet Performer is worth about $50.5 million dollars.

2. Regression Analysis

a. What is the expected relationship between ship price and each factor listed in Exhibit 4 (size, age, and charter rates)? The Baltic Dry Capesize Index in Exhibit 4 provides a composite measure of charter rates for capsize ships across markets (see the first paragraph on p.3). What is the economic logic for why each factor might affect ship value?

```
rm(list=ls())
gc()

library(readxl)
pj <- read_excel("C:/Users/yijia/OneDrive - University of Rochester/Desktop/Courses/Core Statistics for MS Students Using R/assign/4/ShipCaseData.xlsx")
head(pj)

summary(lm(SalePrice~Age,data=pj))
plot(pj$Age, pj$SalePrice)
abline(lm(SalePrice~Age,data=pj), col="maroon")
```

Conclusion: When age increases, the sale price decreases.

```
summary(lm(SalePrice~DWT,data=pj))
plot(pj$DWT, pj$SalePrice)
abline(lm(SalePrice~DWT,data=pj), col="maroon")
```

Conclusion: When the DWT becomes larger, the sale price goes up.

```
summary(lm(SalePrice~Cindex,data=pj))
plot(pj$Cindex, pj$SalePrice)
abline(lm(SalePrice~Cindex,data=pj), col="maroon")
```

Conclusion: The ship with a higher cindex will have a higher sale price.

Age matters because every ship has limited time length of usage. The older the ship, then the shorter the time until it is abandoned. So when age increases, the sale price decreases.
DWT is the size of the ship. The larger the ship is, the more goods it can contain. So when the DWT becomes larger, the sale price goes up.
Cindex represents a composite measure of charter rates for capsize ships across markets. The cindex increases due to a combination of factors, including a booming global economy, increasing global supply chains, etc. So the ship with a higher cindex will have a higher sale price.

b. Can you think of other factors that might predict ship prices?

1) The speed of the ship. The faster the speed is, the shorter time it will take to travel or deliver goods. So I think the ship with a faster speed will be more expensive.
2) The decoration of the ship. The price of the decoration depends on what material it uses, the style, and the atmosphere it creates. So the ship with a more luxurious decoration will be more expensive.

c. Using the data from all ships in Exhibit 4, run a multiple regression of SalePrice on DWT, Age, and Cindex. How well do all three factors jointly explain ship prices? In other words, what percentage of the variation in ship prices does your model explain?

reg = lm(SalePrice~Age+DWT+Cindex,data=pj)

summary(reg)

All three factors are significant at 5% level. And the F-stat is significant at 1% level, meaning the whole model can explain the price well.

R^2 =0.9204, meaning that 92.04% of the variation in ship prices with the regression using the three predictors.

d. Using all three factors, what is the predicted price for the Bet Performer? Compute a 95% confidence interval for an average ship like the Bet Performer and a 95% prediction interval for the Bet Performer itself. Note that Bet Performer is an 11-year-old, 172K capesize bulk carrier. In May 2008, when the potential client shows interest in buying a ship, the trailing 1-year average monthly Baltic Dry Capsize Index (charter rates) is 12,479 (Exhibit 4).

predict(reg, data.frame(Age=11,DWT=172,Cindex = 12,479, interval="none"))

The price of the Bet Performer is about $36 million dollars.

predict(reg, data.frame(Age=11,DWT=172,Cindex = 12,479), interval="confidence")

The 95% confidence interval for an average ship like the Bet Performer is (26.156, 45.803).

predict(reg, data.frame(Age=11,DWT=172,Cindex = 12,479), interval="prediction")

The 95% prediction interval for the Bet Performer itself is (13.773, 58.186)

e. What would the price be if the Bet Performer were 5 years younger (6 years old rather than 11 years old), if the ship were 20K DWT smaller (152K DWT rather than 172K DWT) or if charter rates in May 2008 were 30% lower (the trailing Capesize Index were 8,735 instead of 12,479)? In each case, assume all other factors remain the same (e.g., when considering the 6-year-old ship case, keep the other factors at 172K DWT and 12,479 Capesize Index). No need for confidence intervals here.

predict(reg, data.frame(Age=6,DWT=172,Cindex = 12,479, interval="none"))

predict(reg, data.frame(Age=11,DWT=152,Cindex = 12,479, interval="none"))

predict(reg, data.frame(Age=11,DWT=172,Cindex = 8,735, interval="none"))

If the Bet Performer were 5 years younger, the price will be $58.70 million dollars.

If the ship were 20K DWT smaller, the price will be $31.14 million dollars.

If charter rates in May 2008 were 30% lower, the price will be $35.95 million dollars.

3. If you were Basil Karatzas, what would you recommend to your client regarding an offer price for the Bet Performer? What concerns, if any, would you have? What recommendations would you make?

- If you recommend that your client should bid, then please also provide how much to offer/bid (specific number) and explain you reasoning.
- If you recommend your client do something else, please explain.
- Also, if you have any additional concerns/thoughts, please describe them.

I have concerns about the inaccuracy of the price prediction, since the 95% prediction interval for the Bet Performer itself is (13.773, 58.186), and the difference between the upper and lower bound is too large, so I will not recommend my client to bid.