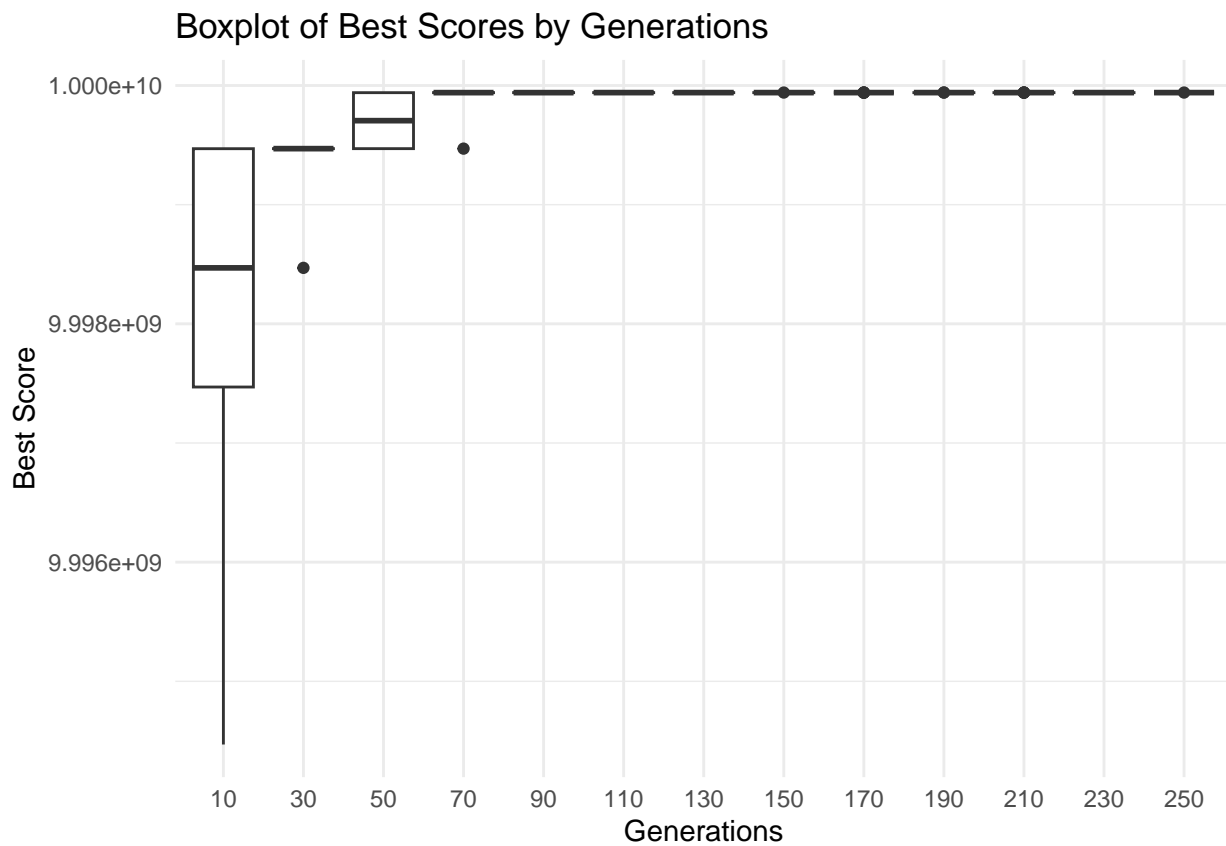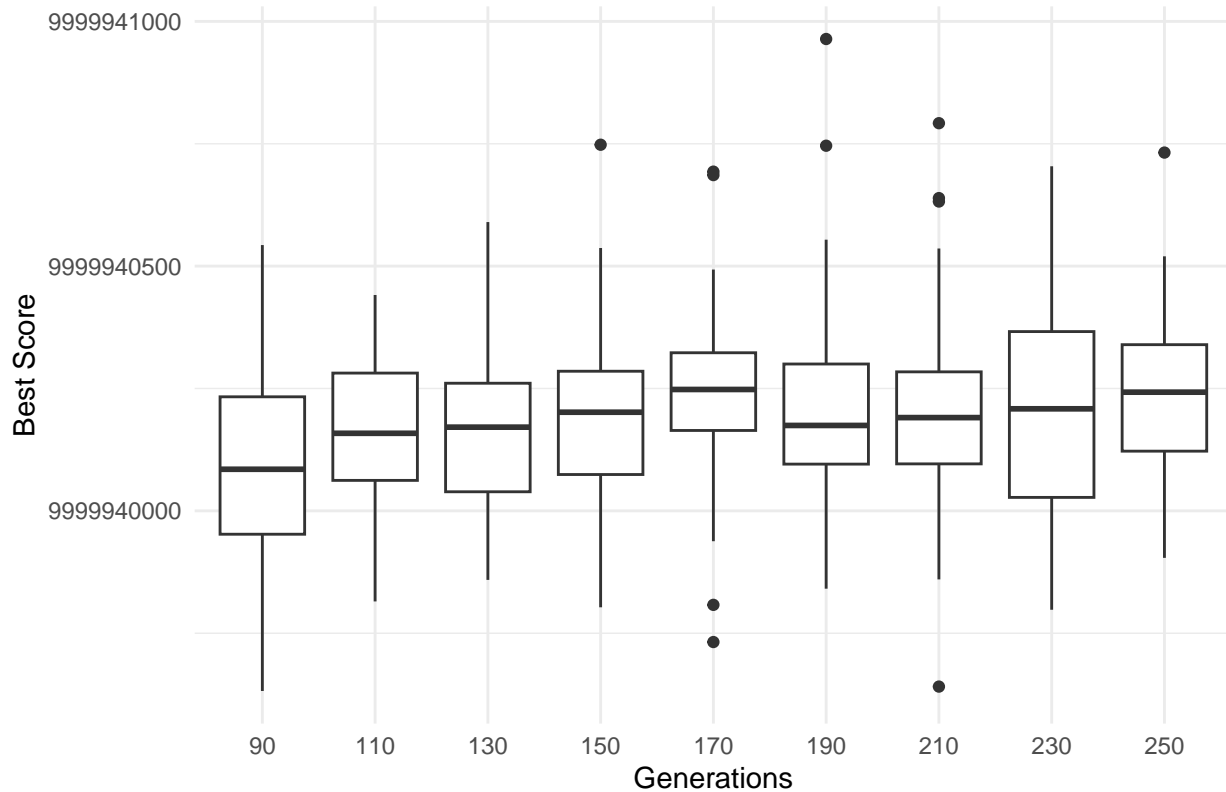```r
library(ggplot2)

data <- read.csv("knapsack_results_250base_inc20.csv")
filtered_data <- subset(data, !(generations %in% c(10, 30, 50, 70)))

boxplot
ggplot(data, aes(x = as.factor(generations), y = best_score)) +
  geom_boxplot() +
  labs(title = "Boxplot of Best Scores by Generations",
       x = "Generations",
       y = "Best Score") +
  theme_minimal()
```

## Boxplot of Best Scores by Generations



```r
ggplot(filtered_data, aes(x = as.factor(generations), y = best_score)) +
  geom_boxplot() +
  labs(title = "Filtered Boxplot of Best Scores by Generations",
       x = "Generations",
       y = "Best Score") +
  theme_minimal()
```

Filtered Boxplot of Best Scores by Generations


```r
wilcox_results <- pairwise.wilcox.test(data$best_score,
                                       as.factor(data$generations),
                                       p.adjust.method = "bonferroni")
print("Pairwise Wilcoxon Test Results (All Data):")
```

```
## [1] "Pairwise Wilcoxon Test Results (All Data):"
```

```r
print(wilcox_results)
```

```
##
##  Pairwise comparisons using Wilcoxon rank sum test with continuity correction
##
## data:  data$best_score and as.factor(data$generations)
##
##     10      30      50      70      90      110     130     150     170
## 30  1.7e-12 -       -       -       -       -       -       -       -
## 50  8.8e-15 2.1e-05 -       -       -       -       -       -       -
## 70  5.5e-16 6.6e-16 3.9e-08 -       -       -       -       -       -
## 90  5.5e-16 5.5e-16 5.4e-11 1.00000 -       -       -       -       -
## 110 5.5e-16 5.5e-16 2.0e-13 0.00101 1.00000 -       -       -       -
## 130 5.5e-16 5.5e-16 4.6e-13 0.00360 1.00000 1.00000 -       -       -
## 150 5.5e-16 5.5e-16 2.1e-13 0.00068 1.00000 1.00000 1.00000 -       -
## 170 5.5e-16 5.5e-16 2.2e-14 4.1e-06 0.03791 1.00000 1.00000 1.00000 -
## 190 5.5e-16 5.5e-16 1.0e-13 0.00035 1.00000 1.00000 1.00000 1.00000 1.00000
## 210 5.5e-16 5.5e-16 2.2e-13 0.00058 1.00000 1.00000 1.00000 1.00000 1.00000
## 230 5.5e-16 5.5e-16 4.6e-13 0.00132 1.00000 1.00000 1.00000 1.00000 1.00000
## 250 5.5e-16 5.5e-16 3.0e-14 4.9e-06 0.06780 1.00000 1.00000 1.00000 1.00000
##     190     210     230
```

```
## 30  -       -       -
## 50  -       -       -
## 70  -       -       -
## 90  -       -       -
## 110 -       -       -
## 130 -       -       -
## 150 -       -       -
## 170 -       -       -
## 190 -       -       -
## 210 1.00000 -       -
## 230 1.00000 1.00000 -
## 250 1.00000 1.00000 1.00000
##
## P value adjustment method: bonferroni
```