# Statistical Analysis with R

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## 1 Two-Sample t-Test for Equal Means

```
brand1 <- c(10.62, 10.58, 10.33, 10.72, 10.44, 10.74)
brand2 <- c(10.50, 10.52, 10.58, 10.62, 10.55, 10.51, 10.53)
t_test_result_05 <- t.test(brand1, brand2, var.equal = TRUE, alternative = "two.sided", conf
t_test_result_01 <- t.test(brand1, brand2, var.equal = TRUE, alternative = "two.sided", conf
print(t_test_result_05)

##
##  Two Sample t-test
##
## data:  brand1 and brand2
## t = 0.4371, df = 11, p-value = 0.6705
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -0.1104937  0.1652556
## sample estimates:
## mean of x mean of y
##  10.57167  10.54429

print(t_test_result_01)

##
##  Two Sample t-test
##
## data:  brand1 and brand2
## t = 0.4371, df = 11, p-value = 0.6705
## alternative hypothesis: true difference in means is not equal to 0
## 99 percent confidence interval:
##  -0.1671738  0.2219357
## sample estimates:
## mean of x mean of y
##  10.57167  10.54429
```

# 2 Paired t-Test for SAT Scores

```
before <- c(1280, 1200, 1050, 1190, 1250, 1290, 1220, 1270, 1260)
after  <- c(1380, 1310, 1090, 1240, 1290, 1360, 1270, 1330, 1310)
t_test_sat_05 <- t.test(after, before, paired = TRUE, alternative = "greater", mu = 50, conf
t_test_sat_10 <- t.test(after, before, paired = TRUE, alternative = "greater", mu = 50, conf
print(t_test_sat_05)
```

```
##
##  Paired t-test
##
## data:  after and before
## t = 1.5689, df = 8, p-value = 0.07765
## alternative hypothesis: true mean difference is greater than 50
## 95 percent confidence interval:
##  47.53021      Inf
## sample estimates:
## mean difference
##        63.33333
```

```
print(t_test_sat_10)
```

```
##
##  Paired t-test
##
## data:  after and before
## t = 1.5689, df = 8, p-value = 0.07765
## alternative hypothesis: true mean difference is greater than 50
## 90 percent confidence interval:
##  51.46269      Inf
## sample estimates:
## mean difference
##        63.33333
```

# 3 F-Test for Equal Variance (Fish Lengths)

```
coast1 <- c(18.8, 20.5, 20.0, 21.0, 17.8, 18.2, 17.8, 19.5, 20.0, 18.2, 18.4, 19.8, 19.8, 20
coast2 <- c(19.8, 21.0, 20.0, 19.5, 18.9, 18.0, 18.5, 18.2, 20.2, 19.0, 19.2, 20.2, 19.2, 17
f_test_05 <- var.test(coast1, coast2, conf.level = 0.95)
f_test_01 <- var.test(coast1, coast2, conf.level = 0.99)
print(f_test_05)
```

```
##
```

```
##  F test to compare two variances
##
## data:  coast1 and coast2
## F = 1.0499, num df = 14, denom df = 19, p-value = 0.9031
## alternative hypothesis: true ratio of variances is not equal to 1
## 95 percent confidence interval:
##  0.3966568 3.0035342
## sample estimates:
## ratio of variances
##           1.049922
```

```
print(f_test_01)
```

```
##
##  F test to compare two variances
##
## data:  coast1 and coast2
## F = 1.0499, num df = 14, denom df = 19, p-value = 0.9031
## alternative hypothesis: true ratio of variances is not equal to 1
## 99 percent confidence interval:
##  0.288618 4.292898
## sample estimates:
## ratio of variances
##           1.049922
```

# 4 Chi-Square Test for Independence (Machine Breakdowns)

```
breakdowns <- matrix(c(41, 20, 12, 16, 31, 11, 9, 14, 15, 17, 16, 10), nrow = 3, byrow = TRU
chi_test_05 <- chisq.test(breakdowns, correct = FALSE)
print(chi_test_05)
```

```
##
##  Pearson's Chi-squared test
##
## data:  breakdowns
## X-squared = 11.649, df = 6, p-value = 0.07027
```

# 5 Goodness of Fit Test for Poisson Distribution

```r
observed_counts <- c(24, 30, 31, 11, 6)
x_values <- 0:4
total_count <- sum(observed_counts)
lambda_hat <- sum(x_values * observed_counts) / total_count
poisson_probs <- dpois(x_values, lambda = lambda_hat)
expected_counts <- total_count * poisson_probs
chisq_test_poisson <- chisq.test(x = observed_counts, p = poisson_probs, rescale.p = TRUE)
```

```
## Warning in chisq.test(x = observed_counts, p = poisson_probs, rescale.p
## = TRUE): Chi-squared approximation may be incorrect
```

```r
print(chisq_test_poisson)
```

```
##
##  Chi-squared test for given probabilities
##
## data:  observed_counts
## X-squared = 2.4898, df = 4, p-value = 0.6465
```