**FINM3123 Introduction to Econometrics**

**Solution to Mid-term Test**

1. **Multiple choice questions (30 points):**
2. C
3. D
4. A
5. D
6. C
7. B
8. C
9. A
10. C
11. B
12. D
13. C
14. B
15. B
16. C

**II. Problems (50 points)**

1. (12 points)
2. (14 points)
3. The t-ratio is equal to .

The number of degrees of freedom is .

The critical value is .

Since , we cannot reject H0 at the 5% significance level. In other words, operating expenses and taxes is not a significant predictor of rental rates at the 5% level.

1. The F-ratio is equal to

Another way to compute it is to use the formulation:

They are equal up to float rounding errors (the exact value is ).

The critical value is .

Since , we reject H0 at the 5% significance level. In other words, expenses and vacancy are jointly significant predictor of rental rates at the 5% level (even though they are not significant at the 5% level when taken individually).

1. (12 points)
2. An estimator is a consistent estimator of a parameter if for any ,  
   In other words, is a consistent estimator of if and only if it converges to in probability.
3. The consistency of requires the following four assumptions:

MLR.1: the population model is linear in the parameters,

MLR.2: the dataset is obtained by random sampling from the population,

MLR.3: there is no perfect collinearity among the explanatory variables,

MLR.4: the conditional mean of the error is zero: .

Remark that the assumption MLR.4 can be replaced by the following weaker assumption:

MLR.4’: and for all .

1. Write y =  + *x* + *u*, and take the expected value: E(*y*) =  + E(*x*) + E(*u*), or *µ*y =  + *µx* since E(*u*) = 0, where *µ*y = E(*y*) and *µx* = E(*x*). We can rewrite this as  = *µ*y − µ*x*. Now,  =  − . Taking the plim of this we have plim() = plim( − ) = plim() – plim()plim() = *µ*y − *µx*, where we use the fact that plim() = *µ*y and plim() = µ*x* by the law of large numbers, and plim() = .
2. (12 points)

Model 1 unrestricted:   
Model 2 restricted:

,

We perform the test against . We can either perform a t-test or an F-test.

T-ratio:   
F-ratio:

We need to use the following result: for any degrees of freedom .

Therefore

This proves that, when adding a new explanatory variable to a linear model, the adjusted will increase if and only if the t-statistic of the new explanatory variable is greater than 1.