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Bus 274: Further Statistics for Business

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PROBLEM SHEET # 12

Problem: In an effort to analyze the cost of his staff, which consists of full-time and part-time employees, the manager of a restaurant uses a simple linear regression model with the weekly number of guests served (independent variable X) and the corresponding number of working hours to serve the guests (dependent variable Y). Data from 15 weeks are:

week	guests	hours	week	guests	hours	week	guests	hours
1	214	146	6	246	108	11	235	141
2	145	98	7	78	49	12	96	66
3	223	129	8	296	149	13	66	54
4	294	166	9	165	100	14	121	87
5	170	103	10	151	88	15	107	72

Fitting a regression line results in the following computer output:

```
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 24.21419    8.19542   2.955   0.0112 *
guests       0.45753    0.04356  10.504 1.01e-07 ***
---
Residual standard error: 12.16 on 13 degrees of freedom
Multiple R-squared: 0.8946,Adjusted R-squared: 0.8865
F-statistic: 110.3 on 1 and 13 DF,  p-value: 1.014e-07
```

a) Write the equation of the estimated regression line.

b) Give an interpretation of the intercept of the regression line. Why should we be careful with this interpretation?

c) Give an interpretation of the slope of the regression line.

d) In this example, $R^2 = 0.895$. Explain what this means.

e) Explain what the p-value `Pr(>|t|)` of `1.01e-07` means. (Hint: Which hypothesis is tested? Under what assumption is this p-value computed? For the number, `1.01e-07`$\equiv 1.01 \times 10^{-7} \equiv$ 0.000000101.)

f) Suppose we expect 160 guests next week. How many working hours will be needed to serve them? The point prediction is 97 hours. Show the formula giving this value. Use the residual standard error to obtain an approximate 95% prediction interval for the number of hours.