1. Award: 10.00 points Problems? Adjust credit for all students.

There has been a lot of discussion regarding the relationship between Scholastic Aptitude Test (SAT) scores and test-takers' family income (*New York Times*, August 27, 2009). It is generally believed that the wealthier a student's family, the higher the SAT score. Another commonly used predictor for SAT scores is the student's grade point average (GPA). Consider the following portion of data collected on 24 students.

SAT	Income	GPA
1,651	47,000	2.79
1,581	34,000	2.97
1,790	90,000	3.48
1,626	60,000	2.5
1,754	113,000	2.92
1,754	71,000	3.76
1,706	105,000	2.8
1,765	59,000	3.26
1,786	50,000	3.89
1,686	27,000	3.67
1,790	107,000	3.31
1,707	109,000	3.16
1,804	81,000	3.73
1,712	62,000	3.21
1,607	72,000	2.8
1,738	63,000	3.7
1,790	55,000	3.86
1,796	64,000	3.91
1,547	47,000	2.63
1,692	89,000	2.98
1,711	42,000	3.45
1,689	70,000	3.06
1,740	118,000	2.88
1,940	113,000	3.96

Click here for the Excel Data File

Estimate three models:

a-1. SAT $= \beta_0 + \beta_1$Income $+ \varepsilon$. **(Round your answers to 4 decimal places.)**

Model 1: $\widehat{SAT}$ = *1,616.3627 ± .0001* + *0.0015 ± .0001* Income

a-2. SAT $= \beta_0 + \beta_1$GPA $+ \varepsilon$. **(Round your answers to 4 decimal places.)**

Model 2: $\widehat{SAT}$ = *1,259.6376 ± .0001* + *141.4680 ± .0001* GPA

a-3. SAT $= \beta_0 + \beta_1$Income $+ \beta_2$GPA $+ \varepsilon$. **(Round your answers to 4 decimal places.)**

Model 3: $\widehat{SAT}$ = *1,104.2580 ± .0001* + *0.0017 ± .0001* Income + *150.9920 ± .0001* GPA

b. Use goodness-of-fit measures to select the best-fitting model.

- Model 1
- Model 2
- Model 3

c. Use the best-fitting model to predict SAT given the mean value of the explanatory variable(s). **(Round**

intermediate calculations to 4 decimal places and final answer to 2 decimal places.)

$\widehat{SAT}$ 1,723.07 ± 0.5

Explanation:

a.
This table reports the regression results from each model:

Variable	Model 1	Model 2	Model 3
Intercept	1,616.3627	1,259.6376	1,104.2580
Income	0.0015	NA	0.0017
GPA	NA	141.4680	150.9920
s_e	76.2217	56.6262	32.4902
R^2	0.2211	0.5701	0.8649
Adjusted R^2	0.1857	0.5506	0.8520

Notes: Parameter estimates are in the top half of the table. The lower part of the table contains goodness-of-fit measures

Using the excel output, the three models are:
Model 1: $\widehat{SAT}$ = 1,616.3627 + 0.0015Income
Model 2: $\widehat{SAT}$ = 1,259.6376 + 141.4680GPA
Model 3: $\widehat{SAT}$ = 1,104.2580 + 0.0017Income + 150.9920GPA

b.

Since the models have different numbers of explanatory variables, we use Adjusted R^2 to compare models. Since Model 3 has the highest Adjusted R^2(0.8520), Model 3 is the best fitting model. Model 3 also has the lowest standard error of the estimate.

c.

We compute mean value of the explanatory variables as $\overline{Income}$ = 7,2833.33 and $\overline{GPA}$ = 3.2783. Using Model 3 (the best model),
$\widehat{SAT}$ = 1,104.2579 + 0.0017(7,2833.33) + 150.9920(3.2783) = 1,723.07

References **eBook & Resources**

Worksheet	Learning Objective: 14-03 Estimate the simple linear regression model and interpret the coefficients.	Learning Objective: 14-05 Calculate and interpret the standard error of the estimate.
Difficulty: 3 Hard	Learning Objective: 14-04 Estimate the multiple linear regression model and interpret the coefficients.	