Instructions

(1) Please read the instruction carefully. Also take this habit with you into the exam room.
(2) Please read each question carefully and answer the questions straightforwardly. Always provide economic reasons at lease a paragraph for your analysis, or a graph when necessary, even when the question does not indicate so.
(3) Handing and submitting assignments are only available via BE Moodle.

Answering the questions and preparing answer sheets

(1) Answers are to be handwritten, in either digital or analog form, in a blank canvas or any clean paper. Make sure that your handwriting is clearly visible and readable.
(2) There is no need to rewrite the question. Just indicate the question number clearly for each of the answer, such as 1.a).
(3) Default decimal point is 4.
(4) Choose precise wordings, especially when you want to interpret the meaning of a test, confidence interval, or coefficients.
(5) When done, for the digital case, collage all the pages into a single PDF file. For those who write on sheets of paper, take photo of all pages then convert all of them into a single PDF file as well.
(6) Name your PDF file as StudentID_YourNickname, such as 640123456_Bo.

Submitting your answers

(1) Make sure your file does not exceed 10MB. This is the maximum file size for BE Moodle upload.
(2) Login to BE Moodle, head into the course, then the assignment topic.
(3) Choose your file to submit. Done. There will be timestamp for your upload date and time, so please make sure to not submit later than that.

For all questions, answer up to 4 decimal places

Question 1. (15 points) Given this information

$$n = 18 \qquad \sum_{i=1}^{n} X_i = 388.00 \qquad \sum_{i=1}^{n} Y_i = 50.90$$

$$\sum_{i=1}^{n} (X_i)^2 = 9{,}620.00 \qquad \sum_{i=1}^{n} X_i Y_i = 1{,}254.90$$

$$\sum_{i=1}^{n} (X_i - \bar{X})^2 = 211.00 \qquad \sum_{i=1}^{n} (Y_i - \bar{Y})^2 = 2.5844$$

$$\sum_{i=1}^{n} (X_i - \bar{X})(Y_i - \bar{Y}) = 20.58 \qquad \sum_{i=1}^{n} \hat{u}_i^{\,2} = 0.5781$$

Use the above sample information to answer all the following questions. Show explicitly all formulas and calculations.

a) From regression model: $Y_i = \beta_1 + \beta_2 X_i + u_i,\ u_i \sim NIID\left(0, \sigma^2\right)$, **find the estimators** of β_1 and β_2 with OLS method. Interpret the intercept and slope coefficients.

b) Compute the value of R^2 and explain its meaning.

c) If $X_i = 30$, estimate the value of $\hat{Y}_i$ and explain its meaning.

d) Calculate the estimators of $\operatorname{var}(u_i)$, $\operatorname{var}\left(\hat{\beta}_1\right)$ and $\operatorname{var}\left(\hat{\beta}_2\right)$.

e) What are the 90-percent confident intervals for β_2 ? Interpret the meaning.

f) Test the hypothesis whether the slope coefficients are different from zero at 0.05 level of significance.

a) OLS $y = b_1 + b_2 x + e$

$$b_2 = \frac{\sum (x-\bar{x})(y-\bar{y})}{\sum (x-\bar{x})^2} \qquad \bar{x} = \frac{\sum x}{N}$$

$$b_1 = \bar{y} - b_2 \bar{x} \qquad \bar{y} = \frac{\sum y}{N}$$

Step 1 $\bar{x} = \frac{\sum x}{N} = \frac{388}{18} = 21.5555$

$\bar{y} = \frac{\sum y}{N} = \frac{50.90}{18} = 2.8278$

Step 2 in b_2

$$b_2 = \frac{\sum (x-\bar{x})(y-\bar{y})}{\sum (x-\bar{x})^2} = \frac{20.58}{211.00} = 0.0975$$

Step 3

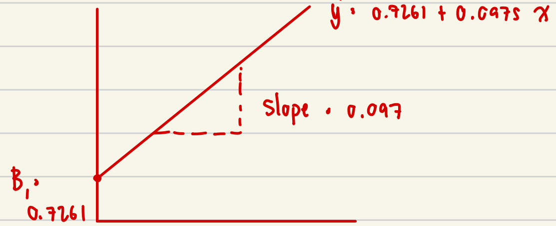
$b_1 = \bar{y} - b_2 \bar{x} = 2.8278 - 0.0975\,(21.5555)$

$b_1 = 0.7261$

$\therefore \hat{y} = 0.7261 + 0.0975\,x$ [Regression]

(slope)
$B_2 = 0.0975$, if x changes by 1 unit, y will change by 0.0975 unit

$B_1 = 0.7261$; if $x = 0$, $\hat{y} = 0.7261$



b) $R^2 = \frac{ESS}{TSS}$ $\quad R^2 = 1 - \frac{RSS}{TSS}$

$ESS = \Sigma(\hat{y} - \bar{y})^2$ $\quad TSS = \Sigma(y - \bar{y})^2$ $\quad RSS = \Sigma U^2 = \Sigma(\hat{y} - y)^2$

$R^2 = 1 - \frac{0.5781}{2.5844} = 0.7763$

" The variation of y can be explained by x = 77.63 % "

c) $\hat{y} = 0.7261 + 0.0975\,x$

$x = 30$

$\hat{y} = 0.7261 + 0.0975\,(30)$

$\hat{y} = 3.6511$

D) $var(\hat{U}) = \frac{\Sigma \hat{U}^2}{n-2} = \frac{0.5871}{18-2} = 0.0361$

$var(b_2) = \frac{var(\hat{U})}{\Sigma(x-\bar{x})^2} = \frac{0.0361}{211.00} = 0.00017$

$var(b_1) = \frac{var(\hat{U}) \cdot \Sigma x^2}{n \cdot \Sigma(x-\bar{x})^2} = \frac{0.0361\,(9620.00)}{18\,(211.00)} = 0.0914$

Confident interval B^2

$= b \pm \left[t_{\frac{\alpha}{2}, n-2} \right] \cdot \frac{S(b)}{\sqrt{n}}$

Step 1 : $\alpha = 0.1/2 = 0.05$

Step 2 : $SD(B) = \sqrt{var(B_2)}$

$SD(b_2) = \sqrt{0.00017}$

$SD(b_2) = 0.0130$

Step 3 Con $= 0.0875 \pm 1.746 \cdot \frac{0.0130}{\sqrt{18}}$

$= 0.0921, 0.1028$

$\therefore$ according to the regression, the true B_2 is between 0.0921 and 0.1028 at 90% significant level.

f). Test hypothesis

Step 1 : $H_0 : B_2 = 0$

$H_1 : B_2 \neq 0$

Step 2 : $\alpha/2 = 0.05/2 = 0.025$

Step 3 : t- test

$$t = \frac{\hat{b} - B}{\sqrt{\frac{var(B)}{N}}}$$

$$t = \frac{0.0975 - 0}{\sqrt{\frac{0.3122}{18}}}$$

$$t = 1.3247$$

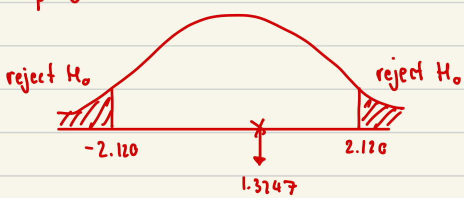
Step 4 : $df = n - 2$

$= 18 - 2$

$= 16$

$t_{0.025, 16} = 2.120$

Step 5



$\therefore$ fail to reject H_0 at 0.05 significant level

Question 2. Using the 2015 Health and Welfare Survey from the National Statistical Office, a simple linear regression is modeled as follows,

$$outp_i = \beta_1 + \beta_2 age_i + u_i$$

where $outp_i$ is how many times person i has visited hospital in 2015, from 0 to 7 times
age_i is how old is person i, from 0 to 97 years.

We assume that both $outp_i$ and age_i are continuous, the estimation results in the following table. Answer the following questions and show your work.

Source	SS	df	MS			
				Number of obs	=	27,886
				F(1, 27884)	=	186.96
Model	77.5444409	1	77.5444409	Prob > F	=	0.0000
Residual	11565.0627	27,884	.414756231	R-squared	=	0.0067
				Adj R-squared	=	0.0066
Total	11642.6072	27,885	.417522223	Root MSE	=	.64402

outp	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
age	.0031338	.0002292	Omitted		.0026846	.003583
_cons	.4279898	.0140339			.4004828	.4554969

a) Test if both parameters are significantly different from zero or not. Use $\alpha = 0.05$.
b) Interpret the meaning of $\hat{\beta}_2$. Does the sign of $\hat{\beta}_2$ make economic sense? Explain.
c) If $outp_i$ is turned into natural logarithmic scale (ln), how would you reinterpret the relationship between $\hat{\beta}_2$ and $\widehat{outp}_i$, assumed that the given coefficient given in the table above can be used to interpret this new functional form.
d) If age_i variable is divided by 10, how does it affect both the coefficients, standard errors, and confidence intervals? Answer the changes of both the constant and slope (if there is).
e) Find the confidence interval of mean prediction at the age of 50 years old, given that $var(\hat{Y}_0) = 0.00002$ and $\alpha = 0.01$.

Question 3. Discuss in a short paragraph why the confidence interval for both the mean prediction and individual prediction get larger as the X_0 is further away from $\bar{X}$.

Question 2. Using the 2015 Health and Welfare Survey from the National Statistical Office, a simple linear regression is modeled as follows,

จำนวนครั้งที่ไปโรงพยาบาล

สร้างสมการ

$$outp_i = \beta_1 + \beta_2 age_i + u_i$$

อายุ

where $outp_i$ is how many times person i has visited hospital in 2015, from 0 to 7 times

age_i is how old is person i, from 0 to 97 years.

We assume that both $outp_i$ and age_i are continuous, the estimation results in the following table. Answer the following questions and show your work.

STATA

จำนวนของข้อมูล

```
      Source |       SS           df       MS      Number of obs   =    27,886
-------------+----------------------------------   F(1, 27884)     =    186.96
       Model |  77.5444409         1  77.5444409   Prob > F        =    0.0000
    Residual |  11565.0627    27,884  .414756231   R-squared       =    0.0067
-------------+----------------------------------   Adj R-squared   =    0.0066
       Total |  11642.6072    27,885  .417522223   Root MSE        =    .64402

------------------------------------------------------------------------------
        outp | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
         age |   .0031338   .0002292                       .0026846     .003583
       _cons |   .4279898   .0140339       Omitted         .4004828    .4554969
------------------------------------------------------------------------------
```

① ②

Constant

$outp = B_1 + B_2\, age + U$

$B_2 = 0.0031338$ เพราะอยู่กับ age

$B_1 = 0.4279898$ เพราะอยู่ตัวเดียวเป็น constant

Standard error = วัดการกระจายของข้อมูล, โอกาสผิดพลาด (Se เยอะโอกาสผิดเยอะ)

Regression : $outp = 0.4278998 + 0.0031338\, age$

$Se(B_1) = 0.014$ $Se(B_2) = 0.000229$

test hypothesis 6 ขั้นตอน

a) Test if both parameters are significantly different from zero or not. Use $\alpha = 0.05$.

ค่า b_1 กับ b_2

Significant level

test b_1

Step 1 set hypothesis

$H_0 : B_1 = 0$

$H_1 : B_1 \neq 0$

Step 2 : Significant level

Significant level = 0.05

two tails

Significant level/2 = 0.025

Step 3 : t-test

$t\text{-test} = \dfrac{\hat{B}_1 - B_1}{Se(B)}$

$t\text{-test} = \dfrac{0.42789 - 0}{0.014}$

t-test = 30.56

df = n - จำนวน B

df = 27886 - 2 = 27884

Step 4 T - table

0.025 , df = 27884

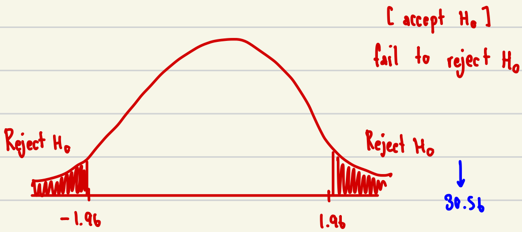
= 1.96

Table 2 T-Distribution Table

$P(t > 2.23) = .025 \quad \text{d.f.} = 10$

df	0.25	0.2	0.15	0.1	0.05	0.025	0.02	0.01	0.005	0.0025	0.001	0.0005
	Tail probability p											
1	1.000	1.376	1.963	3.078	6.314	12.706	15.895	31.821	63.657	127.321	318.309	636.619
2	0.816	1.061	1.386	1.886	2.920	4.303	4.849	6.965	9.925	14.089	22.327	31.599
3	0.765	0.978	1.250	1.638	2.353	3.182	3.482	4.541	5.841	7.453	10.215	12.924
4	0.741	0.941	1.190	1.533	2.132	2.776	2.999	3.747	4.604	5.598	7.173	8.610
5	0.727	0.920	1.156	1.476	2.015	2.571	2.757	3.365	4.032	4.773	5.893	6.869
6	0.718	0.906	1.134	1.440	1.943	2.447	2.612	3.143	3.707	4.317	5.208	5.959
7	0.711	0.896	1.119	1.415	1.895	2.365	2.517	2.998	3.499	4.029	4.785	5.408
8	0.706	0.889	1.108	1.397	1.860	2.306	2.449	2.896	3.355	3.833	4.501	5.041
9	0.703	0.883	1.100	1.383	1.833	2.262	2.398	2.821	3.250	3.690	4.297	4.781
10	0.700	0.879	1.093	1.372	1.812	2.228	2.359	2.764	3.169	3.581	4.144	4.587
11	0.697	0.876	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.025	4.437
12	0.695	0.873	1.083	1.356	1.782	2.179	2.303	2.681	3.055	3.428	3.930	4.318
13	0.694	0.870	1.079	1.350	1.771	2.160	2.282	2.650	3.012	3.372	3.852	4.221
14	0.692	0.868	1.076	1.345	1.761	2.145	2.264	2.624	2.977	3.326	3.787	4.140
15	0.691	0.866	1.074	1.341	1.753	2.131	2.249	2.602	2.947	3.286	3.733	4.073
16	0.690	0.865	1.071	1.337	1.746	2.120	2.235	2.583	2.921	3.252	3.686	4.015
17	0.689	0.863	1.069	1.333	1.740	2.110	2.224	2.567	2.898	3.222	3.646	3.965
18	0.688	0.862	1.067	1.330	1.734	2.101	2.214	2.552	2.878	3.197	3.610	3.922
19	0.688	0.861	1.066	1.328	1.729	2.093	2.205	2.539	2.861	3.174	3.579	3.883
20	0.687	0.860	1.064	1.325	1.725	2.086	2.197	2.528	2.845	3.153	3.552	3.850
21	0.686	0.859	1.063	1.323	1.721	2.080	2.189	2.518	2.831	3.135	3.527	3.819
22	0.686	0.858	1.061	1.321	1.717	2.074	2.183	2.508	2.819	3.119	3.505	3.792
23	0.685	0.858	1.060	1.319	1.714	2.069	2.177	2.500	2.807	3.104	3.485	3.768
24	0.685	0.857	1.059	1.318	1.711	2.064	2.172	2.492	2.797	3.091	3.467	3.745
25	0.684	0.856	1.058	1.316	1.708	2.060	2.167	2.485	2.787	3.078	3.450	3.725
26	0.684	0.856	1.058	1.315	1.706	2.056	2.162	2.479	2.779	3.067	3.435	3.707
27	0.684	0.855	1.057	1.314	1.703	2.052	2.158	2.473	2.771	3.057	3.421	3.690
28	0.683	0.855	1.056	1.313	1.701	2.048	2.154	2.467	2.763	3.047	3.408	3.674
29	0.683	0.854	1.055	1.311	1.699	2.045	2.150	2.462	2.756	3.038	3.396	3.659
30	0.683	0.854	1.055	1.310	1.697	2.042	2.147	2.457	2.750	3.030	3.385	3.646
40	0.681	0.851	1.050	1.303	1.684	2.021	2.123	2.423	2.704	2.971	3.307	3.551
50	0.679	0.849	1.047	1.299	1.676	2.009	2.109	2.403	2.678	2.937	3.261	3.496
60	0.679	0.848	1.045	1.296	1.671	2.000	2.099	2.390	2.660	2.915	3.232	3.460
80	0.678	0.846	1.043	1.292	1.664	1.990	2.088	2.374	2.639	2.887	3.195	3.416
100	0.677	0.845	1.042	1.290	1.660	1.984	2.081	2.364	2.626	2.871	3.174	3.390
1000	0.675	0.842	1.037	1.282	1.646	1.962	2.056	2.330	2.581	2.813	3.098	3.300
∞	0.674	0.842	1.036	1.282	1.645	1.960	2.054	2.326	2.576	2.807	3.090	3.291

Step 5



Reject H_0 (H_0 ไม่เป็นจริง)

Step 6 Summarize

B_1 is different from zero at 0.05 significant level ※

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test b_2

Step 1 : set hypothesis

$H_0 : B_2 = 0$

$H_1 : B_2 \neq 0$

Step 2

Significant level = 0.025

Step 3 t - test

$$= \frac{\hat{B}_2 - B_2}{Se_{(B)}}$$

df = n - จำนวน B

= 27886 - 2 = 27884

$$= \frac{0.0031338 - 0}{0.002292} = 13.6728$$

Step 4 : t - table

0.025 , 27844

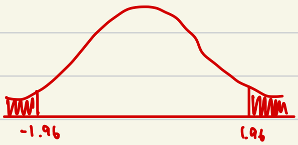
= 1.960

Table 2 T-Distribution Table

$P(t > 2.23) = .025 \quad \text{d.f.} = 10$

df	0.25	0.2	0.15	0.1	0.05	0.025	0.02	0.01	0.005	0.0025	0.001	0.0005
	Tail probability p											
1	1.000	1.376	1.963	3.078	6.314	12.706	15.895	31.821	63.657	127.321	318.309	636.619
2	0.816	1.061	1.386	1.886	2.920	4.303	4.849	6.965	9.925	14.089	22.327	31.599
3	0.765	0.978	1.250	1.638	2.353	3.182	3.482	4.541	5.841	7.453	10.215	12.924
4	0.741	0.941	1.190	1.533	2.132	2.776	2.999	3.747	4.604	5.598	7.173	8.610
5	0.727	0.920	1.156	1.476	2.015	2.571	2.757	3.365	4.032	4.773	5.893	6.869
6	0.718	0.906	1.134	1.440	1.943	2.447	2.612	3.143	3.707	4.317	5.208	5.959
7	0.711	0.896	1.119	1.415	1.895	2.365	2.517	2.998	3.499	4.029	4.785	5.408
8	0.706	0.889	1.108	1.397	1.860	2.306	2.449	2.896	3.355	3.833	4.501	5.041
9	0.703	0.883	1.100	1.383	1.833	2.262	2.398	2.821	3.250	3.690	4.297	4.781
10	0.700	0.879	1.093	1.372	1.812	2.228	2.359	2.764	3.169	3.581	4.144	4.587
11	0.697	0.876	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.025	4.437
12	0.695	0.873	1.083	1.356	1.782	2.179	2.303	2.681	3.055	3.428	3.930	4.318
13	0.694	0.870	1.079	1.350	1.771	2.160	2.282	2.650	3.012	3.372	3.852	4.221
14	0.692	0.868	1.076	1.345	1.761	2.145	2.264	2.624	2.977	3.326	3.787	4.140
15	0.691	0.866	1.074	1.341	1.753	2.131	2.249	2.602	2.947	3.286	3.733	4.073
16	0.690	0.865	1.071	1.337	1.746	2.120	2.235	2.583	2.921	3.252	3.686	4.015
17	0.689	0.863	1.069	1.333	1.740	2.110	2.224	2.567	2.898	3.222	3.646	3.965
18	0.688	0.862	1.067	1.330	1.734	2.101	2.214	2.552	2.878	3.197	3.610	3.922
19	0.688	0.861	1.066	1.328	1.729	2.093	2.205	2.539	2.861	3.174	3.579	3.883
20	0.687	0.860	1.064	1.325	1.725	2.086	2.197	2.528	2.845	3.153	3.552	3.850
21	0.686	0.859	1.063	1.323	1.721	2.080	2.189	2.518	2.831	3.135	3.527	3.819
22	0.686	0.858	1.061	1.321	1.717	2.074	2.183	2.508	2.819	3.119	3.505	3.792
23	0.685	0.858	1.060	1.319	1.714	2.069	2.177	2.500	2.807	3.104	3.485	3.768
24	0.685	0.857	1.059	1.318	1.711	2.064	2.172	2.492	2.797	3.091	3.467	3.745
25	0.684	0.856	1.058	1.316	1.708	2.060	2.167	2.485	2.787	3.078	3.450	3.725
26	0.684	0.856	1.058	1.315	1.706	2.056	2.162	2.479	2.779	3.067	3.435	3.707
27	0.684	0.855	1.057	1.314	1.703	2.052	2.158	2.473	2.771	3.057	3.421	3.690
28	0.683	0.855	1.056	1.313	1.701	2.048	2.154	2.467	2.763	3.047	3.408	3.674
29	0.683	0.854	1.055	1.311	1.699	2.045	2.150	2.462	2.756	3.038	3.396	3.659
30	0.683	0.854	1.055	1.310	1.697	2.042	2.147	2.457	2.750	3.030	3.385	3.646
40	0.681	0.851	1.050	1.303	1.684	2.021	2.123	2.423	2.704	2.971	3.307	3.551
50	0.679	0.849	1.047	1.299	1.676	2.009	2.109	2.403	2.678	2.937	3.261	3.496
60	0.679	0.848	1.045	1.296	1.671	2.000	2.099	2.390	2.660	2.915	3.232	3.460
80	0.678	0.846	1.043	1.292	1.664	1.990	2.088	2.374	2.639	2.887	3.195	3.416
100	0.677	0.845	1.042	1.290	1.660	1.984	2.081	2.364	2.626	2.871	3.174	3.390
1000	0.675	0.842	1.037	1.282	1.646	1.962	2.056	2.330	2.581	2.813	3.098	3.300
∞	0.674	0.842	1.036	1.282	1.645	1.960	2.054	2.326	2.576	2.807	3.090	3.291

Step 5



Step 6

B_2 is different from zero at 0.05 significant level

b) Interpret the meaning of $\hat{\beta}_2$. Does the sign of $\hat{\beta}_2$ make economic sense? Explain.

Theory ไม่มี log ไม่มี ln

1. linear $y = B_1 + B_2 x + u$

if x change by 1 unit y will change $= B_2$ Unit

2. Double log : $\ln y = B_1 + B_2 \ln x + u$

if x change by 1 %, y will change $= B_2$ %

3. linear log : $y = B_1 + B_2 \ln x$

if x change by 1 %, y will change $B_2/100$ unit

4. log - lin $\ln y = B_1 + B_2 x$

if x change by 1 unit, y will change $B_2 \times 100$ %

จากโจทย์

$outp = 0.4278 + 0.0031\, age$

ไม่มี ln เลย

1. จากโจทย์พบว่าเป็น equation ประเภท linear

if age increases by 1 year, outp will increases by 0.031 time

∴ Base on my own experience, when we grow older we will be more vulnerable. So, we need to go to the hospital more often. I think that this equation sentence is make sense. ✻

c) If $outp_i$ is turned into natural logarithmic scale (ln), how would you reinterpret the relationship between $\hat{\beta}_2$ and $\widehat{outp}_i$, assumed that the given coefficient given in the table above can be used to interpret this new functional form.

Theory ไม่ใส่ log ไม่ใส่ ln

① linear $y = B_1 + B_2 x + u$

if x change by 1 unit y will change $= B_2$ Unit

② Double log : $\ln y = B_1 + B_2 \ln x + u$

if x change by 1 %, y will change $= B_2$ %

③ linear log : $y = B_1 + B_2 \ln x$

if x change by 1 %, y will change $B_2/100$ unit

④ log - lin $\ln y = B_1 + B_2 x$

if x change by 1 unit, y will change $B_1 \times 100$ %

จากโจทย์

$outp = 0.4278 + 0.0031\ age$

$\ln outp = 0.4278 + 0.0031\ age$ ปรับใหม่

if age increase by 1 year, outp will increase by 0.0031×100 %

$= 0.31$ %

d) If age_i variable is divided by 10, how does it affect both the coefficients, standard errors, and confidence intervals? Answer the changes of both the constant and slope (if there is).

x

$outp = B_1 + B_2\ age + u$

$y = B_1 + B_2 x + u$

$$\hat{B}_2 = \frac{\Sigma [x - \bar{x}][y - \bar{y}]}{\Sigma [x - \bar{x}]^2}$$

$$\hat{B}_1 = \bar{y} - \hat{b}_2 x$$

Standard error

$Ste = \frac{SD}{\sqrt{N}}$ $SD = \sqrt{Var}$

$$var(B_2) = \frac{\sigma^2}{\Sigma [x - \bar{x}]^2} \qquad var(B_1) = \frac{\sigma^2 \Sigma x^2}{n \Sigma (x - \bar{x})^2}$$

d).

x ใหม่ $= x$ เก่า $/ 10$ [จากโจทย์]

$$\hat{B}_2 \text{ ใหม่} = \frac{\Sigma [x^N - \bar{x}^N][y - \bar{y}]}{\Sigma [x_N - \bar{x}]^2}$$

$$\hat{B}_2 \text{ ใหม่} = \frac{\Sigma [\frac{x}{10} - \frac{\bar{x}}{10}][y - \bar{y}]}{\Sigma [\frac{x}{10} - \frac{\bar{x}}{10}]^2} = \frac{\frac{1}{10} \Sigma [x - \bar{x}][y - \bar{y}]}{[\frac{1}{10}]^2 \Sigma [x - \bar{x}]^2}$$

$$\hat{B}_2 \text{ ใหม่} = \frac{\Sigma [x^N - \bar{x}^N][y - \bar{y}]}{[\frac{1}{10}] \Sigma [x - \bar{x}]^2}$$

$$= \frac{1}{0.1} \left[\frac{\Sigma (x - \bar{x})(y - \bar{y})}{\Sigma (x - \bar{x})^2} \right]$$

$$B_2 \text{ ใหม่} = \frac{B \text{ เก่า}}{0.1} = \frac{0.0031}{0.1} = 0.031 \ \#$$

$$\hat{B}_1 N = \bar{y} - b_2^N \bar{x}$$

$$\hat{B}_1 N = \bar{y} - \left[\frac{B_2}{0.1}\right]\left[\frac{\bar{x}}{10}\right]$$

$$\hat{B}_1 N = \bar{y} - B_2 \bar{x}$$

$$\hat{B}_1 = \hat{B}_{\text{เก่า}} = 0.4272 \ \#$$

e) $\hat{y}_0 = 0.428 + 0.0031 (50) = 0.583$

from $se(\hat{y}_0) = \sqrt{var(\hat{y}_0)}$

$= 0.0045$

significant level $= 0.01/2 = 0.005$

$t_{0.005, \infty} = 2.576$

$Pr(0.583 - (2.576)(0.0045) \leq Y_0 \leq 0.583 + (2.576)(0.0045))$

$= 0.99$

$Pr(0.5714 \leq Y_0 \leq 0.5946) = 0.99 \ \#$

Question 3

$$Var(\hat{y}_0) = \sigma^2 \left[\frac{1}{n} + \frac{(x_0 - \bar{x})^2}{\Sigma(x_i - \bar{x})^2} \right]$$

if $x_0 - \bar{x}$ gets larger, the larger of variance leading to larger $se(\hat{y}_0)$

$\bar{x}$ is the central tendency of x_i, the less information of x_i is available. Since, the Confidence interval must be larger to get the more unknown value.