Name.....Student ID.....Seat number.....

King Mongkut's University of Technology Thonburi

Midterm Examination

Semester 1 Academic Year 2017

CVE 221 Surveying

ENV 213 Surveying for Environmental Engineering 2nd Year International Program

Date: Monday 2 October 2017 Time 13.00 - 16.00

Instructions:

1. There are 4 questions, total of 13 pages (includes cover, 90 points).
2. Write your answers in the question sheets **ONLY.**
3. An approved calculator is **allowed** in the examination room.
4. Any documents or textbooks is n**ot allowed** in the examination room.

Examiner: Thongchai Phothong

(Tel. 0-2470-9147)

This examination paper has been approved by the Department of Civil Engineering

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for (Associate Professor Dr. Sutat Leelataviwat)

Head of the Civil Engineering Department

Name.....Student ID.....Seat number.....

1. A steel tape with nominal length of 30 m. was used to measure a base line from A to B. The observed results and conditions are in Table 1.1. The standard conditions are temperature 18°C, tape length 29.997 m., with tension 95 N, expansion coefficient $1.3 \times 10^{-6}/1^{\circ}C$, area 3.35 mm^2, weight 0.025 kg./m., E 14.8×10^4 MN/m^2, g = 9.81 m/sec^2. Calculate corrected distance from A to B. (15 marks)

Table 1.1 The observed data and conditions

Section	Observed distance, m.	Differnt in elevation, m.	Tension, N	Temperature, °C
A-1	29.988	+0.346	145	14
1-2	29.895	-0.214	145	14
2-3	29.838	-0.309	145	14
3-B	29.910	-0.106	145	14

Answer

Name.....Student ID.....Seat number.....

2. Table 2.1 shows measured data of a rectangle, calculate

2.1 Standard deviation of each side (15 marks).

2.2 Distance of each side at the confidence level of 80% (5 marks)

2.3 Area of the rectangle with error propagation (5 marks).

Table 2.1 The observed data

Width		Length	
Number	Observed distance, m.	Number	Observed distance, m.
1	38.236	1	55.333
2	38.235	2	55.336
3	38.234	3	55.332
4	38.238	4	55.334
5	38.239	5	55.335
6	38.235	6	55.334
7	38.233	7	55.332
8	38.234	8	55.335
9	38.233	9	55.336
10	38.232	10	55.336

Answer

Name.....Student ID.....Seat number.....

3. Figure 3.1 shows a leveling map work of cave's ceiling. Calculate

3.1 Closing error of leveling data in Table 3.1 (12 marks).

3.2 Elevation of each points (5 marks).

3.3 Estimate contour line of the cave's ceiling with contour interval equals 0.50 m (8 marks)

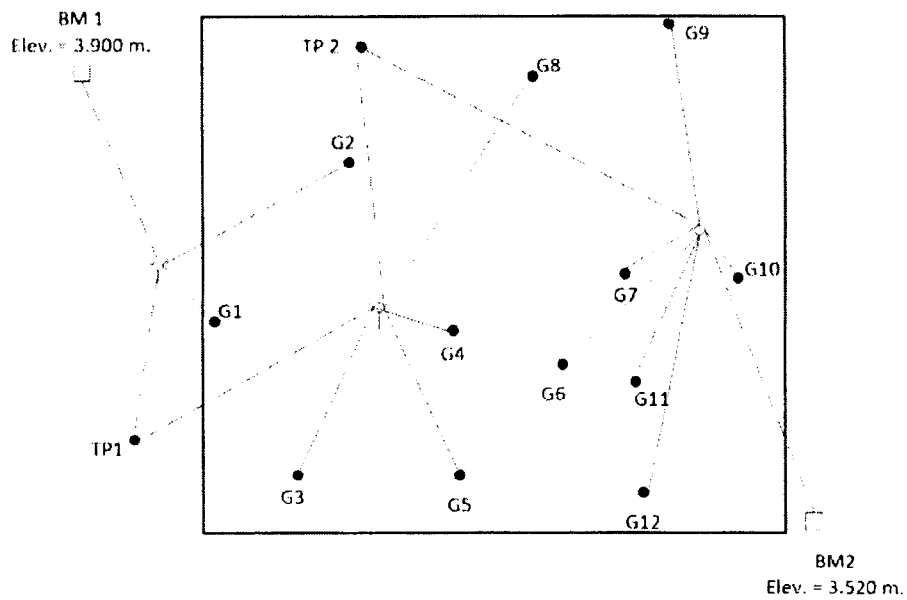


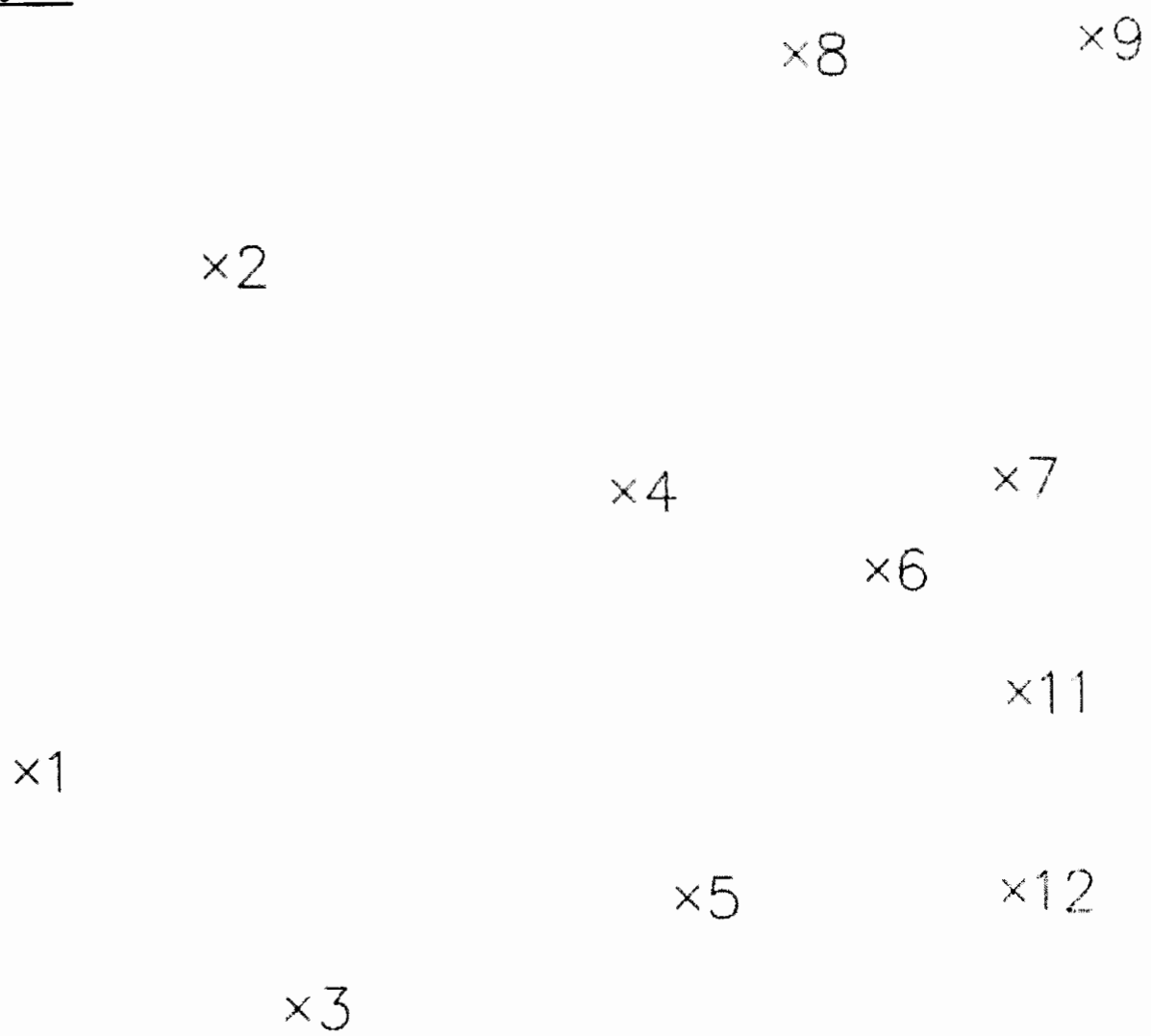
Figure 3.1 The leveling map

Table 3.1 The observed data

STA	BS UPPER MIDDLE LOWER	IFS	FS UPPER MIDDLE LOWER
BM09	2.468		
	2.358		
	2.248		
G1		-3.782	
G2		-1.772	
TP1	1.102		1.614
	1.010		1.510
	0.920		1.408
G3		-4.062	
G4		-1.192	
G5		-1.762	
G8		-0.072	
TP2	0.503		2.258
	0.387		2.160
	0.270		2.062
G6		-1.675	
G7		-0.995	
G9		-0.325	
G10		-0.225	
G11		-1.425	
G12		-1.925	
BM03			0.558
			0.460
			0.362

Name.....Student ID.....Seat number.....

Drawing area



Remarks G1-G12 represented by 1-12

Name.....Student ID.....Seat number.....

4. Table 4.1 shows observed data of a level network. Calculate

4.1 closing error of each loop (3 marks).

4.2 Elevation of each point by the Successive Method when elevation of BM5 equals 100.000 m. (27 marks).

Table 4.1 The leveling map

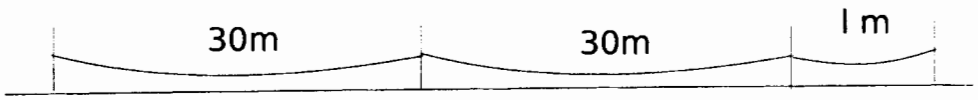
Loop	Side	Dist. (km.)	Diff (m.)
Loop 1			
	BM-7 to 8	5	-22.011
	BM-8 to 2	3	4.088
	BM-2 to 7	12	17.925
Loop 2			
	BM-8 to 2	3	4.088
	BM-2 to 4	15	3.925
	BM-4 to 8	10	-8.022
Loop 3			
	BM-5 to 1	20	-3.925
	BM-1 to 7	25	16.98
	BM-7 to 8	5	-22.011
	BM-8 to 4	10	8.022
	BM-4 to 5	15	0.925

Name.....Student ID.....Seat number.....

Equations

$C_t = L_m \alpha (t_m - t_s)$ Temperature correction

$C_{sa} = -\frac{L_m^3}{24}\frac{(mg)^2}{p_m^2}$, Sag correction TIP: If distance longer than tape length, the distance have to divide to tape length + the remaining length.



$C_p = \frac{L_m(P_m - P)}{AE}$ Tension correction

$C_i = L_m(1 - \cos\alpha)$ Slope correction

$C_m = \frac{-L_m h}{R+h}$ Mean sea level correction

$$E_z = \pm\sqrt{(\frac{\partial f}{\partial l_1})^2 E_{l_1}^2 + (\frac{\partial f}{\partial l_2})^2 E_{l_2}^2 + (\frac{\partial f}{\partial l_3})^2 E_{l_3}^2 + \ldots + (\frac{\partial f}{\partial l_n})^2 E_{l_n}^2}$$

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