resection sheet

- PanZhiQing 24037665g

Three-point resection

1. From the known coordinates of A, B, and C calculate lengths a and c, and angle α at station B. c: 41.7350262608734 a: 6.963461782748601 alpha: 169-4-12

2. Subtract the sum of angles x, y, and α in figure ABCP from 360° to obtain the sum of angles A + C

$$A + C = 360° - (\alpha + x + y)$$

   - A + C: 65-14-23

3. Calculate angles A and C using the following:

   - A: 22-49-31
   - C: 42-24-51

4. From angle A and azimuth AB, calculate azimuth AP in triangle ABP. Then solve for length AP using the law of sines, where $\alpha\alpha$1 = 180° - A - x.Calculate the ΔE and ΔN of AP followed by the coordinates of P.

   - Solve the triangle ABP(Round1):
   - AP: 32.62646401200535
   - azimuthAB: 12-24-10
   - azimuthAP: 35-13-52
   - deltaE: 26.65030422241778 deltaN: 18.82146218494358
   - **P: 836537.5433042224 818647.9924621849**

- Solve the triangle ABP(Round2):
   - AP: 32.619147037426494
   - azimuthAB: 12-24-10
   - azimuthAP: 35-17-17
   - deltaE: 26.62555889420214 deltaN: 18.843788552746577
   - **P: 836537.5185588943 818648.0147885528**

5. In the manner outlined in step 4, use triangle BCP to calculate the coordinates of P to obtain a check.

   - Solve the triangle BCP(Round1):
      - CP : 11.41923988409439
      - azimuthBC: 203-19-57
      - azimuthCP: 160-55-6
      - deltaE: -10.791793992092192 deltaN: 3.7331249594321028
      - **P : 836547.2562060079, 818644.6261249594**
      - Difference between P1 and P2: 9.717117445543408 3.3613701018039137
   - Solve the triangle BCP(Round2):
      - CP : 11.455825633046228
      - azimuthBC: 203-19-57
      - azimuthCP: 160-52-4
      - deltaE: -10.823076487008173 deltaN: 3.7545913614040383
      - **P : 836547.2249235129, 818644.6475913614**
      - Difference between P1 and P2: errorE 9.706364618614316 errorN 3.3671971913427114

6. Error between two rounds

  - For P1 only: errorE 0.020529668079689145 errorN 0.02729349152650684

Leveling

- Given the (arbitrary) RL of BM11 as 25.362 mpd.
- Result : 25.362 + 0.171 = 25.533 mpd.

Appendix

Round1

Parameters	Value
c	41.7350262608734
a	6.963461782748601
alpha	169-4-12
X	1.9173459941888038
Y	0.27635834264286885
A	22-49-31
C	42-24-51
AP	32.62015515078579
azimuthAB	12-24-10
azimuthAP	35-13-42
P1	[836537.5390885624, 818647.9874950612]
deltaE	26.646088562305245
deltaN	18.816495061278612
CP	11.41923988409439
azimuthBC	203-19-57
azimuthCP	160-55-6
P2	[836547.2562060079, 818644.6261249594]
deltaE	-10.791793992092192
deltaN	3.7331249594321028

Round2

Parameters	Value
c	41.7350262608734
a	6.963461782748601
alpha	169-4-12
X	1.9156830832625982
Y	0.27609654325506955
A	22-53-7
C	42-27-52
AP	32.619147037426494
azimuthAB	12-24-10

Parameters	Value
azimuthAP	35-17-17
P1	[836537.5185588943, 818648.0147885528]
deltaE	26.62555889420214
deltaN	18.843788552746577
CP	11.455825633046228
azimuthBC	203-19-57
azimuthCP	160-52-4
P2	[836547.2249235129, 818644.6475913614]
deltaE	-10.823076487008173
deltaN	3.7545913614040383

Script Output

source code: resection.py

```
### Round 1 ###
c: 41.7350262608734
a: 6.963461782748601
alpha: 169-4-12
A+C: 65-14-23
X: 1.9173459941888038
Y: 0.27635834264286885
A: 22-49-31
C: 42-24-51
AP: 32.62015515078579
azimuthAB: 12-24-10
azimuthAP: 35-13-42
AP: 11.41923988409439
azimuthAB: 203-19-57
azimuthAP: 160-55-6
P1: [836537.5390885624, 818647.9874950612] deltaE: 26.646088562305245 deltaN: 18.816495061278612
P2: [836547.2562060079, 818644.6261249594] deltaE: -10.791793992092192 deltaN: 3.7331249594321028
errorE 9.717117445543408 errorN 3.3613701018039137
### Round 2 ###
c: 41.7350262608734
a: 6.963461782748601
alpha: 169-4-12
A+C: 65-21-0
X: 1.9156830832625982
Y: 0.27609654325506955
A: 22-53-7
C: 42-27-52
AP: 32.619147037426494
azimuthAB: 12-24-10
azimuthAP: 35-17-17
AP: 11.455825633046228
azimuthAB: 203-19-57
azimuthAP: 160-52-4
P1: [836537.5185588943, 818648.0147885528] deltaE: 26.62555889420214 deltaN: 18.843788552746577
P2: [836547.2249235129, 818644.6475913614] deltaE: -10.823076487008173 deltaN: 3.7545913614040383
errorE 9.706364618614316 errorN 3.3671971913427114
### Between Round Error ###
errorE 0.020529668079689145 errorN 0.02729349152650684
```

The Hong Kong Polytechnic University
Department of Land Surveying & Geo-Informatics
Surveying Practical Exercise Field Sheet

Date: 09/16/2024   Class: LSGI522   Observer: PAN Zhiqing, XU Siyuan, ZENG Jianwen, ZHOU Kaiwen, ZOU Guohao   Booker: PAN Zhiqing

From	To	Face	HCR	VCR	Slope Distance	Mean HCR	Mean VCR	Mean Slope Dist.	Horizontal Dist.	Remarks
STN1	A	L	144 – 52 - 31	89 - 48 - 48	32.664	144-54-53	89-49-8	32.665	32.664	
STN1	B	L	35 - 01 - 55	89 - 20 - 36	17.186	35-3-32	89-20-41	17.186	17.185	
STN1	C	L	19 - 11 - 41	89 - 50 - 11	21.692	19-13-29	89-50-41	21.692	21.692	
STN1	C	R	199 - 08 - 05	270 - 08 - 48	21.692	- -	- -			
STN1	B	R	214 - 58 - 39	270 – 39 - 14	17.186	- -	- -			
STN1	A	R	324 – 47 - 47	270 – 10 - 32	32.665	- -	- -			
			- -	- -	- -	- -	- -			
STN1	A	L	144 - 43 - 34	89 - 50 - 01	32.665	144-42-1	89-49-49	32.665	32.664	
STN1	B	L	34 - 57 - 05	89 - 20 - 41	17.186	34-56-23	89-20-48	17.186	17.185	
STN1	C	L	19 - 07 - 25	89 - 50 - 07	21.691	19-7-14	89-50-42	21.692	21.692	
STN1	C	R	199 - 07 - 46	270 - 08 - 41	21.691	- -	- -			
STN1	B	R	214 - 58 - 29	270 - 39 - 04	17.186	- -	- -			
STN1	A	R	324 - 46 - 39	270 - 10 - 22	32.664	- -	- -			
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Hong Kong Polytechnic University
Department of Land Surveying and Geo-Informatics

Ordinary Levelling Booking Form (Rise and Fall Method)

Locality : BM11   Observer : PAN Zhiqing, XU Siyuan, ZENG Jianwei Date : 09/16/2024
Instrument: Level   Booker : PAN Zhiqing   Group No.: 1

Station	Back Sight	Inter. Sight	Fore Sight	Rise (+)	Fall (-)	Provisional R. Level	Adi.	Reduced Level	Remarks
BM11	1.088					25.362		25.362	
Point1			0.977	0.171		27.072		27.072	