Lesson Plan 2

Charles Jason Tinant

8/29/2018

Engr 233/231-Elementary Surveying Lesson Sheet

Lesson 2 – Chapters 2 & 6

Updates

Homework 1 is due Friday. Please upload the trigonometry review to the Google Scholar website. You will need to use your olc account to register for class. The class code for surveying is **2yh326**.

Orientation:

Surveying has a long history and has evolved technologically both as its own profession and in support of professions Surveyors are required to function comfortably in several different systems of linear and angular measurement. Additionally, calculations have to be made using information from both US customary and System International data sources. Finally, surveyors need to be able to use data from historic sources by converting to modern measurement and reporting systems.

Objectives:

1. Students should be able calculate and convert data from US customary and System International data;
2. Convert historic land measurement data for distances and acreages to current systems.

Reading Assignment:

Ghilani and Wolf
Chapter 2 – Units, and Significant Figures
Read about units of measurement used in modern & historical surveying & geomatics in sections 2.2 - 2.3;
read about significant figures & rounding in sections 2.4 - 2.5;
read about fieldbooks & fieldnotes in sections 2.6 - 2.11 & 2.15.
Scan 2.12 - 2.14 on digital notes.

Chapter 6 - Distance Measurement:
Prepare for the second laboratory (measuring and mapping the perimeter of Area 51 using a total station) by reading sections 6.15-6.22.

In-Class Assignment:

Work in groups of no more than three to:

1. Calculate errors for a distance measurement survey using a metal tape. The survey has a total distance of 2,280 ft (see below, section 6.14 and Appendix A).
2. Calculate the error ratio.
3. Identify the major source of error. What could you do to eliminate this source of error?

4. Upload your work to the Google Scholar website.
5. Set up field book for an EDM survey following Plate B.1. in the Appendix.

HOMEWORK ASSIGNMENT

Due Date: September 14, 2018

2.4b, 2.5b, 2.6b, 2.7a, 2.8a, 2.13b, 2.14 a, b, c, d

Suggested Class Schedule

0:00 - Class Start & Discuss Questions
0:20 – Discuss Rounding & Review Taping Corrections
0:30 - Start in-class assignment on taping errors
0:50 – Break
1:20 – Begin lecture on converting between US customary and System International
1:50 – Break
2:00 – Taping laboratory preparation
2:50 – Class Discussion

EDM laboratory

The laboratory starts at 9 AM Friday at Piya Wiconi. Please work in teams of no more than three to measure the Area 51 building including doors and the two sheds using a total station (clockwise & anti-clockwise).

Survey books and engineering scales are on order and should hopefully arrive soon.

Deliverables: 1. Your completed survey book should look resemble Figure B.1 (Appendix) with both calculations and a map shown.

2. Your length of stride written in the field notes of your lab.

Due Date: September 21, 2018

In-class example problem answers

```
# Calculuate errors and identify as either systematic or random for a
# theoretical taping lab, assuming the following

# Calculations in feet.
# Next step is to learn to use the units package
tape_len_std  <-  100.000          # ft
temp_std      <-   68.000          # deg.F
pull_std      <-   25.000          # lb
k_thermal     <-    0.00000645 # ft per deg.F
tape_wt       <-    0.0266     # lb/ft
tape_area     <-    0.0078     # in^2
mod_elas      <-    29E6       # lb/in^2

dist_meas     <- 2280.000          # ft
num_sta       <-  round(dist_meas/100) # stations
```

```
tape_len_act  <-  100.004      # ft
temp_air      <-   78.1        # deg.F
pull_act      <-   35.7        # lb

# incorrect length of tape error
error_length   <- dist_meas * (tape_len_act - tape_len_std) /
                                  tape_len_std

# temperature error
error_temp     <- dist_meas * k_thermal * (temp_air - temp_std)

# pull error
error_pull     <- (pull_act - pull_std) * dist_meas /
                           (tape_area * mod_elas)

# sag error
error_sag1     <- -(tape_wt^2 * tape_len_act^3) /
                      (24 * pull_act^2)

error_sag2     <- -(tape_wt^2 * 80^3) /
                      (24 * pull_act^2) # not a full length

error_sag      <- (num_sta - 1) * error_sag1 + error_sag2

# horizontal alignment
dist_vert      <-    2.00  # ft

dist_horiz     <- sqrt(tape_len_act^2 - dist_vert^2)

error_align    <- -(tape_len_act - dist_horiz)

# calculate total error and error ratio
error_total    <- error_length + error_temp + error_sag +
                    error_align

error_ratio    <- error_total / dist_meas # ft per ft

#~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
# Answers - the answers do not show correct number of significant
# figures.  Instead, they are showing 'double' precision used to
# store the numbers in computer memory.

# incorrect length of tape error
error_length
```

```
## [1] 0.0912
```

```
# temperature error
error_temp
```

```
## [1] 0.1485306
```

```
# pull error
error_pull
```

```
## [1] 0.1078515
```

```
# sag error
error_sag
```

```
## [1] -0.5208116
```

```
# horizontal alignment
error_align
```

```
## [1] -0.0200012
```

```
# total error
error_total
```

```
## [1] -0.3010822
```

```
# error ratio
error_ratio
```

```
## [1] -0.0001320536
```