CALIFORNIA STATE BOARD OF REGISTRATION
FOR PROFESSIONAL ENGINEERS

LS C

1980
LAND SURVEYOR
PRINCIPLES AND PRACTICE

1. This examination is given in two four-hour periods on the same day. The subject matter relates to the principles and practice of Land Surveying. Part C is the first of two parts.

2. In the workbook, you are to work problems C1 through C5 plus a choice of one from those remaining.

3. You may withdraw from scoring any part of your work by isolating that part and writing VOID across it. Delineate the voided part clearly.

4. Enter your identification number in the upper right-hand corner on each page where space is provided.

5. Read the instructions on the workbook cover page.

6. After you have completed the examination, check the problem order, include all pages, and turn it in to the proctor.

7. You may keep this set of examination questions.

Department of Consumer Affairs
State Board of Registration for Professional Engineers
California
1980

Problem C1 Wt. 5.0 Required

Assume that you are Land Surveyor No. 9999 Licensed in California and that you have surveyed the NW 1/4 of the NW 1/4 of Section 17, Township 7 North, Range 12 East M.D.M. as shown below. The owner desires to deed the East 12 acres to Yolo County for a park.

1. Calculate the placement of the west line of the East 12 acres and assume that you have set those corners according to your calculations.

2. Describe, by metes and bounds, the parcel to be conveyed to the county.

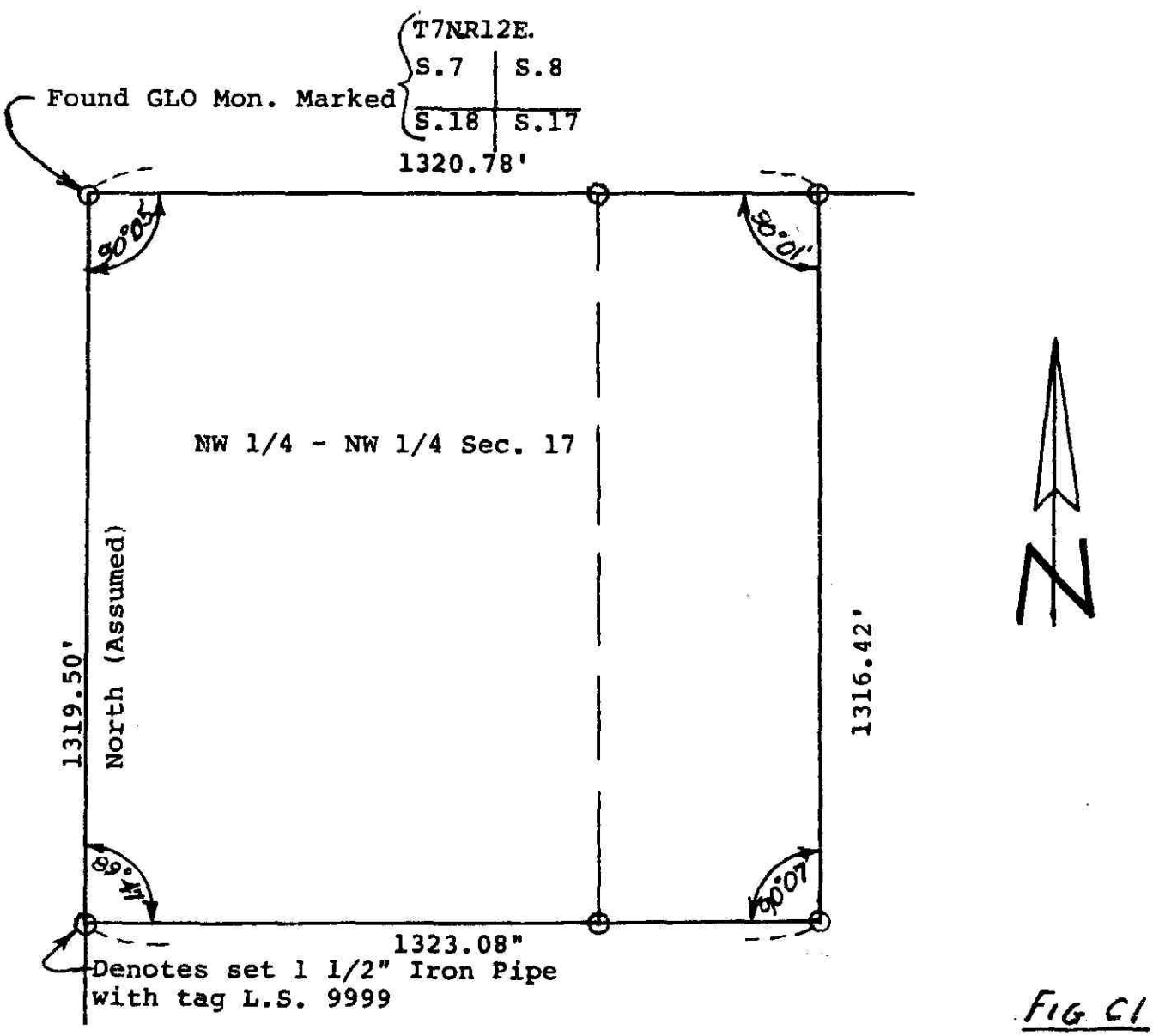
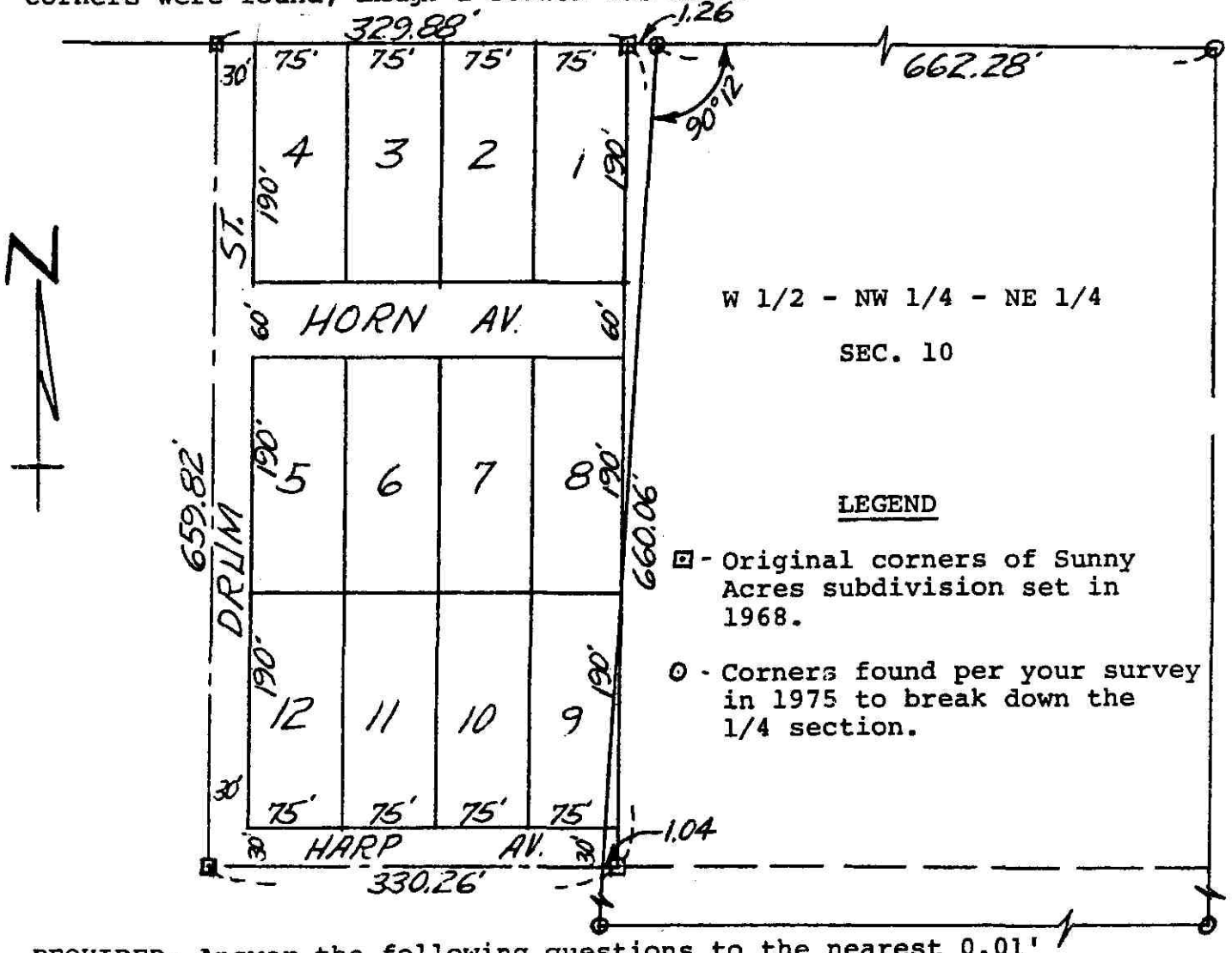


FIG C1

Problem C2 Wt. 10.0 REQUIRED

Below is a portion of Sunny Acres, a subdivision of the E 1/2 of the NE 1/4 of the NW 1/4 of the 1/4 of Section 10. Several years ago, you surveyed the west half of the NW 1/4 of the NE 1/4 and found the illustrated discrepancy. In the course of surveying Lots 1 and 9 for building permits, the exterior monuments were found and measurements were made as shown. No interior lot corners were found, though a search was made.



REQUIRED: Answer the following questions to the nearest 0.01'

1. What are the surveyed dimensions of Lot 1?
2. What are the surveyed dimensions of Lot 9?
3. Outline a procedure that could be followed to rectify the gap/overlap problem.

Problem C3 Wt. 10 Required

Figure 1a shows a part of the original township plat. Figure 1b shows the results of a resurvey.

NOTE: Assume that the original survey was made under instructions identical to those of the 1973 manual.

1. What are the bearings and distances of the boundary of the NE 1/4 NW 1/4 of Lot 3 , Section 6 as determined from the resurvey information in Figure 1b.

2. What is the area of Lot 3 based on the resurvey?

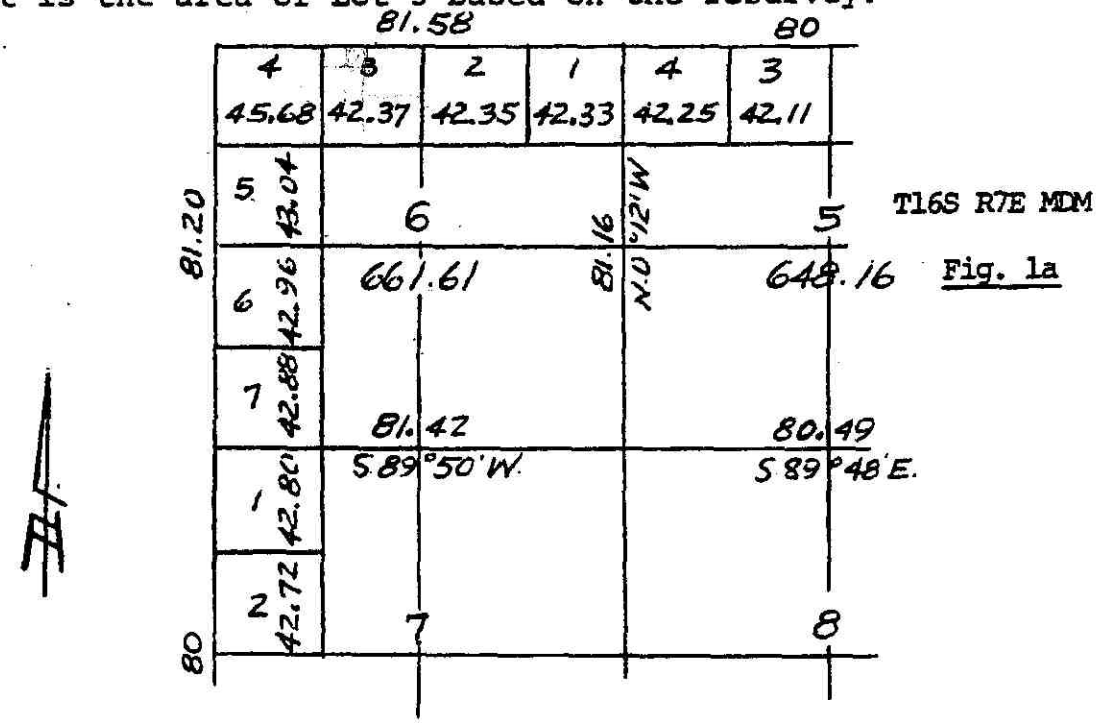


Fig. 1a

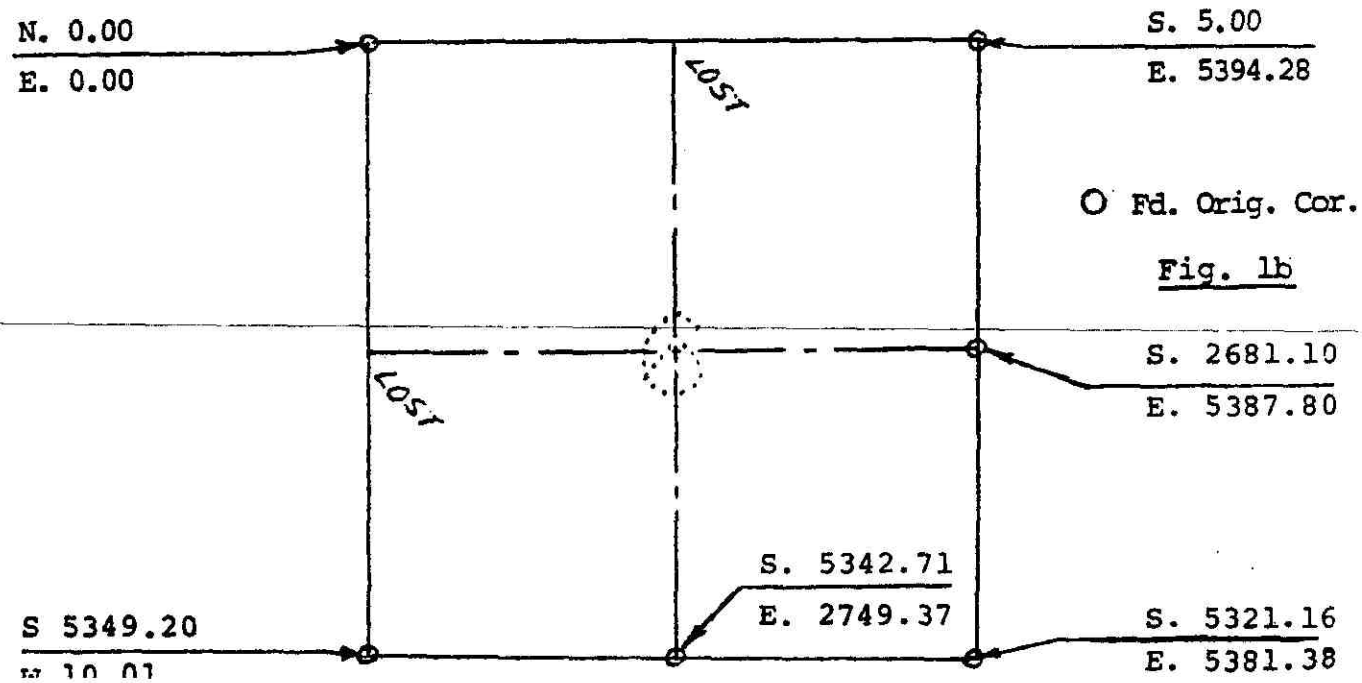


Fig. 1b

Problem C4 Wt. 10.0 REQUIRED

The following questions are based on California law. Answer True or False and give a brief explantation of your answer.

1. A subdivision map filed for a condominimum project must show the method of air-space division.

2. The surveyor or engineer filing a final map must certify on the map that the survey was made by him.

3. Absent a subsequently approved moratorium, the approval of a tentative map must expire within three years.

4. A licensed surveyor may administer an oath to a party giving a deposition in a quiet title action if a notary public is unavailable.

5. A licensed surveyor who issues a report to his client which is not sealed violates the Land Surveyors Act.

6. A licensed surveyor may design a grading plan without being supervised by a professional engineer.

7. A county surveyor may require a licensed surveyor to revise a Record of Survey to conform to a filed County Surveyor's Map prior to filing the Record of Survey with the County Recorder.

8. Subsequent to recordation of a Record of Survey, a surveyor discovers that 2" iron pipes were set at three locations where the map shows as set a #5 rebar with cap. Since this constitutes physical change with respect to recorded information, a new Record of Survey must be filed within 90 days.

9. While establishing offsite cadastral control for a topographic survey, a licensed surveyor is advised by the landowner (his client's adjoinder) that the surveyor is trespassing and must leave at onece. The surveyor is required to comply, limiting his further operations to land owned by his client.

10. Smith has 6 years experience in the field performing geodetic and property retracement surveys, including 3 years as a party chief; he has 2 years office experience in the County Surveyor's geodetic section analyzing and designing geodetic surveys. Smith has the necessary experience to be admitted to the Land Surveyor's Exam.

Problem C-5 Wt. 10.0 REQUIRED

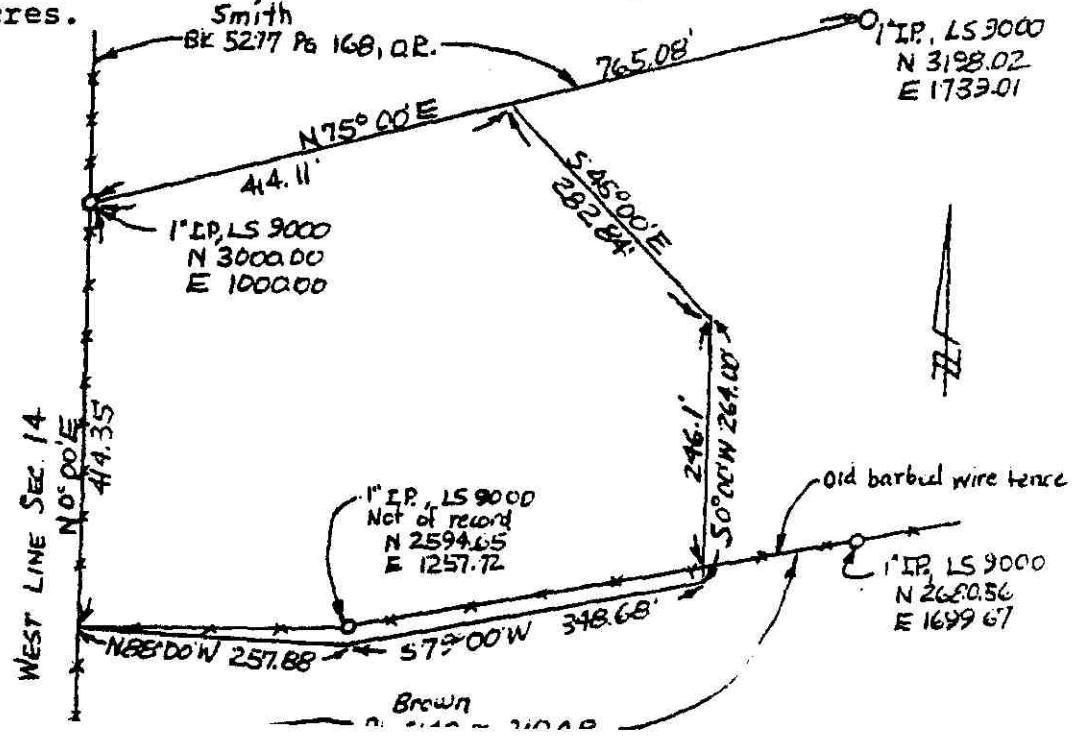
The accompanying sketch represents the parcel of land described below with the results of a field survey of the area.

Required

Analyze the description and the survey and state your findings and conclusions relative to the determination of the location of the boundary of the described parcel. Assume that all of the available data is as shown on the sketch. Discuss fully any errors, omissions or discrepancies and how they affect your solution. The use of statutes, court decisions,reconized survey texts, etc. to support your conclusions is strongly encouraged.

Description (Preamble omitted for brevity):

Beginning at at 1" I.P. tagged LS 9000 at the southwest corner of that property conveyed to Smith by deed recorded March 5, 1937, in Book 5277, Pg 168, Official Records of said County, said corner being on the west line of Section 14, T.4N., R. 6E., SBM; THENCE along the south line of said Smith property N75° 00'E 414.11 feet: THENCE S45°00'E 282.84feet: THENCE S0°00'W 264.00 feet to a point on the north line of that property conveyed to Brown by deed recorded August 20, 1939, in Book 6140, page 210, Official Records of said County; THENCE S79°00'W along said north line 348.68 feet to an angle point therin; THENCE continuing along said north line N88°00'W 257.88 feet to the west line of said Section 14 and the northwest corner of said property of Brown; THENCE N0°00'E 414.35 feet along the west line of said Section 14 to the point of beginning, containing 5.874 acres.



Problem C6 Wt. 5.0 OPTIONAL

Note: Select Problem C6 or C7, do not work both.

Four leveling parties measured the difference in elevation between a known bench mark and point 'P'. Each party used methods and equipment designed to obtain certain maximum limits of random error. All systematic errors were eliminated. The lengths of the level lines for parties A,B,C, and D were 2.6 kilometers, 1.7 kilometers, 3.2 kilometers and .75 kilometers respectively.

Given the following data:

PARTY	MEASURED DIFFERENCE IN ELEVATION BETWEEN BENCH MARK AND POINT 'P'	ACCURACY OF SURVEY METHOD
A	23.020 ft.	.06 meters kilometer
B	22.990 ft.	.08 meters kilometer
C	23.085 ft.	.12 meters kilometer
D	23.000 ft.	.12 meters kilometer

REQUIRED:

Compute the weighted mean value of the difference in elevation from bench mark to point 'P'. Reject any measurement in which the adjustment exceeds the range of the maximum error for that measurement.

Problem C7 Wt. 5.0 OPTIONAL

Note: Select either C6 or C7 - do not work this if you selected C6.

Centeline Road Data for a sag vertical curve

Given: Vertex (V) Station = 16+50.00
Vertex (V) Elevation = 608.99
g1 -4.2%
g2 1.6%
Length = 800 ft.

REQUIRED:

Stations and Elevations at the b v c, the e v c, the lowest point, and at the following stations:

13+50
14+50
15+50
16+50
17+50
18+50
19+50

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L S D

1980
LAND SURVEYOR
PRINCIPLES AND PRACTIVE

1. This examination is given in two four-hour periods on the same day. The subject matter relates to the principles and practice of Land Surveying. Part D is the second of two parts.

2. In the workbook, you are to work Problems D1 and D2 plus a selection of 30 for a total of 50 points.

3. You may withdraw from scoring any part of your work by isolating that part and writing VOID across it. Delineate the voided part clearly.

4. Enter your identification number in the upper fight-hand corner on each page where space is provided.

5. Read the instructions on the workbook cover page.

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Problem D2 Wt. 10.0 REQUIRED

Your client owns sections 15, 16, 21, 22, 27 and 28 in the same township. The highest point of elevation on the project is 2775 feet and the maximum difference in elevation over the six sections is 250 feet. The terrain is rolling in nature and crossed by numerous ridges and arroyos. The ground cover is scrub oak and heavy brush with an average height of five feet.

Your client has stereo photographic coverage of the entire area, which includes contact prints, photo index map and the original negatives. You have determined that the sidelap between flight lines is 25%, that it was flown at 6000 feet above mean terrain and the photo scale is 1:6000.

Your client wants the following:

1. Recovery or reestablishment of all original government corners.

2. Topographic maps at a scale of 1" = 100' with contour intervals of 5 feet.

3. A mosaic of the entire area at a scale of 1" = 250'.

Assume:

That there has not been any survey activity in the area since the original subdivision of the township.

That all sections are 80 chains by 80 chains, nominal.

REQUIRED:

1. What additional reference material, if any, will you need to accomplish Item 1?

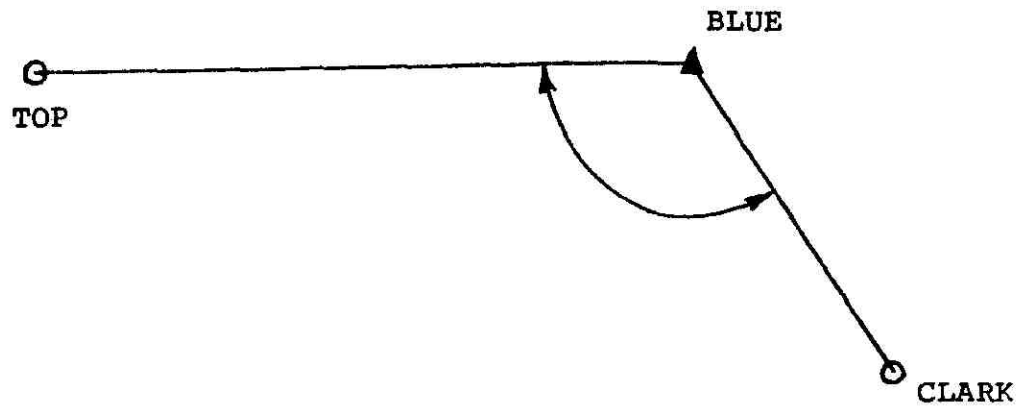
2. Will the existing photography be of any value in accomplishing Item 1? If so, explain.

3. Is the existing photography suitable for either Items 2 or 3? If so, explain.

4. If the existing photography is not suitable for either Items 2 or 3, state what would be required.

5. What is the minimum number of exisiting photographs that your client would have to furnish you to completely cover the area stereoscopically.

Problem D1 Wt. 10.0 REQUIRED



Measured Angle CLARK-TOP

1. 150° 08' 45"
2. 150° 08' 55"
3. 150° 08' 48"
4. 150° 08' 46"
5. 150° 08' 54"
6. 150° 08' 52"

Geodetic Azimuth
BLUE-CLARK= 300°23'39"

Zone 6 Constants

R_b = 32,271,267.72
C = 2,000,000
Y = 424,696.79
$C.M._o$ = 116°15'
l = 0.54951 75982

For BLUE

Lat. 33° 08' 59.976"N
Long. 114° 56' 37.455"W
Elev. 2477 feet
N 360,278.64
E 2,399,808.86
Scale Factor = 0.9999 593

The measured distance from BLUE to TOP, corrected for slope, elevation, and scale, is 6278.14 feet. The EDM equipment used is said to yield a standard error of length of ± 0.03 ft ± 3ppm. The angle at BLUE from CLARK to TOP is given by the observations shown above.

REQUIRED:
Determine the Zone 6 coordinated of TOP and the probable error of those coordinates. Express the results in the form N = xxx,xxx.xx ±x.xx; E = x,xxx,xxx.xx ±x.xx. Assume that the coordinates of BLUE are absolute.

NOTE: A complete solution of this problem requires that all formulae and intermediate calculations be shown.

Problem D 3 Wt. 10.0 OPTIONAL

Note: Select either D3 or D4 do not work both.

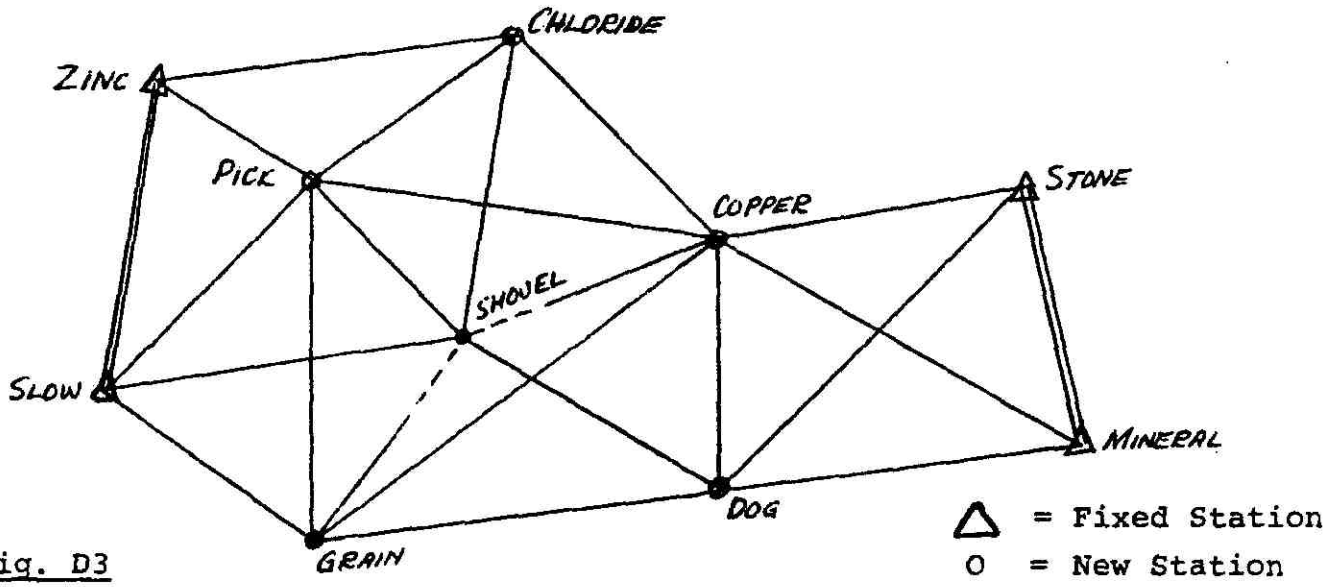


Fig. D3

Assume that this figure is to given a rigorous least-squares adjustment using directions and condition equations. All stations have been occupied and 21 of the 23 lines have been observed both ways.

1. The correct number of angle condition equations is
   (a) 10 (b) 12 (c) 14 (d) 23 (e) 24

2. The correct number of side condition equations is
   (a) 1 (b) 3 (c) 5 (d) 6 (e) 8

3. The total number of conditions equations necessary to achieve the
   (a) 13 (b) 18 (c) 20 (d) 22 (e) 24

4. Which of the following considerations should be particularly observed in the formation of a side equation?

5. If the above figure was to be adjusted by the method of "variation of coordinates", how many equations would be necessary to effect the adjustment?

   (a) 6 (b) 10 (c) 12 (d) 18 (e) 20

6. The relative reliability of lengths computed from a triangulation network is best indicated by which of the following:
   (a) Mathematical closure at fixed points.
   (b) Strength of figure value.
   (c) Sines of the "distance angles".
   (d) The accuracy of the measured lengths.
   (e) The size of the absolute terms of the angle equations.

— Problem D4 Wt. 10.0 OPTIONAL

Note: Do not do this if you have selected D3

State two of the commonly accepted methods of determining azimuth from solar observations. Describe each method in terms of the following:

1. Observations required (kind and quantity).
2. Preferred (if any) time of observation, and why.
3. Expected accuracy of results.
4. Systematic errors that may be encountered, and a method of reducing or eliminating each.
5. Formulae for reduction of the observations, including an explanation of the variables used.

— Problen D5 Wt. 5.0 OPTIONAL

Note: Select Problem D5 or D6, do not work both.

In this section, no government quarter-corners were established. The government survey measured the section lines as shown by the sketch.
You measured the following lines between found corners:
North side A-C 5260.20'ft.
West side A-F 5276.70 ft.
South side F-J 3260.40ft.
East Side C-G 5088.60ft.
REQUIRED: Where shall the quarter corners (B,D,E&H) be set?

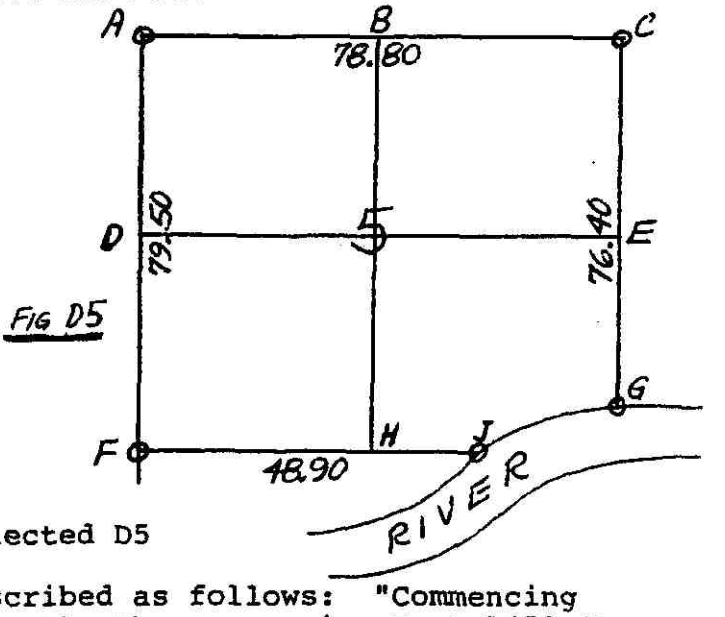


FIG D5

— Problem D6 Wt.5.0 OPTIONAL

Note: Do not do this if you have selected D5

A parcel of land was sold, being described as follows: "Commencing at the north quarter-corner of Section 15; thence running East 1650 ft; thence South 2640 ft; thence West 1650 ft; thence North 2640 ft. to the point of beginning; containing 100 acres, according to the United States Survey."
Figure (a) shows the U.S. survey data (lengths are in chains);
Figure (b) shows results of the survey of the NE 1/4 Sec. 15 (lengths in feet).
REQUIRED:
State the procedures and dimensions to correctly lay out the described parcel.

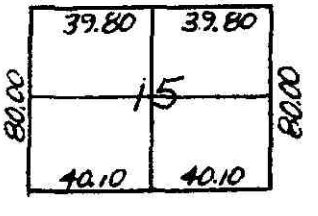


FIG. a

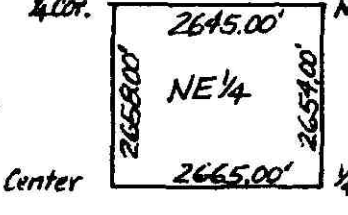


FIG. b

Problem D7 Wt. 5.0 OPTIONAL

Note: Select either D7 or D8 - do not work both

You have been hired to prepare a Parcel Map from "record data". A recently recorded Record of Survey, prepared by another surveyor, has determined the boundary. In checking for the previously set monuments, you determined that the previous surveyor has used an erronous section corner to control his survey. This results in a difference in the position of the true corners and the monumented corners of distances from .5 feet to 3.2 feet. No improvements have been constructed on the property. Your client is in a rush because the interest rate charges are causing problems with his potential sale.

REQUIRED:

A. Describe your actions with regard to your client.

B. Describe your actions with regard to the other surveyor.

C. Describe your actions with regard to the preparation of the Parcel Map.

Problem D8 Wt. 5.0 OPTIONAL

Note: Select either D7 or D8 - do not work this if you selected D7.

The following questions are based on California law. Answer True or False and give a brief explanation of your answer.

1. Parties to a deed may vary the clear and distinct language of the deed by oral testimony showing that the deed did not in fact reflect the parties intent.
2. A conveys the Southwest quarter of Section 2 to B, reserving an easement along the Westerly boundary of the Section. Due to an ambiguity in the deed, it is uncertain whether the reserved easement is 10 or 20 feet wide. In the absence of other evidence, A retains a 20 foot wide easement.
3. Blackacre Estates was surveyed by A and properly recorded in 1929. Lot 1 was sold to X in 1934, who could not find any of A's stakes and had a new survey made by B in 1935. B filed a Record of Survey. A new survey has found both the monuments set by A and by B; X still owns the property. The monuments set by B control.
4. In the absence of other evidence, California courts will discard elements of a deed description in the following order to obtain an unambiguous description: area, angle, distance.
5. Monuments mentioned in a deed description of the boundaries of land conveyed control both bearing and distances given in a deed in case of conflict, but only if the monuments were witnessed by the parties to the deed before its execution.