



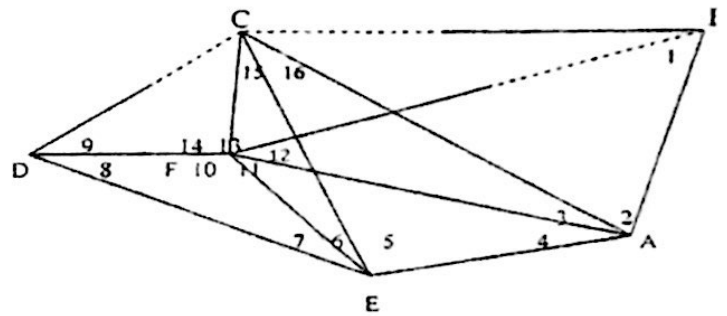
Question (1) (20%)

(This exam measured with ILOS)

- a) (M) and (S) are triangulation stations, the elevation of which are 60 and 600 m. respectively . An obstruction (K) is situated 30 km. and 15 km. from M and S respectively. The elevation of the obstruction is 406 m . Determine the height of the signal at station (S) in order that the line of sight may clear an obstruction (K) by 3.0m by McGraw's Formula. ? Assume that : ($k = 0.07$ & $R = 6370$ km.
- b) An airplane traveling from point E ($32^{\circ} 22' N, 42^{\circ} 34' W$) to point F ($40^{\circ} 42' N, 21^{\circ} 30' E$):
- Determine the total traveling distance EFG?
 - Determine the geodetic area of the spherical triangle EFG?

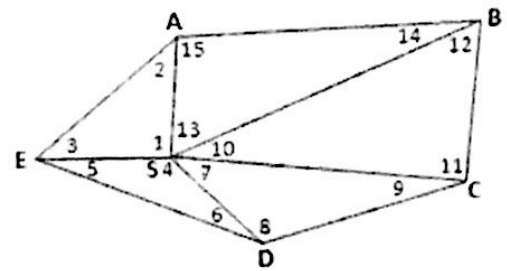
Question (2)(35%)

- a) ABCDEF is a part of free triangulation network chose angle as the figure shown. Calculate the condition equations for its adjustment using two different methods? Write all condition equations? If station D is not occupied, find the number of conditions in this case?



- b) The field abstract for a triangulation scheme established for a small construction site is shown in figure . Using this data , calculate the adjusted angles.

Angle	Observed	Angle	Observed	Angle	Observed
O1	$101^{\circ} 29' 18.4''$	O6	$72^{\circ} 58' 11.7''$	O11	$20^{\circ} 15' 8.10''$
O2	$46^{\circ} 28' 22.1''$	O7	$51^{\circ} 58' 51.2''$	O12	$90^{\circ} 01' 47.1''$
O3	$32^{\circ} 02' 42.9''$	O8	$63^{\circ} 17' 52.9''$	O13	$90^{\circ} 58' 47.6''$
O4	$45^{\circ} 50' 33.9''$	O9	$64^{\circ} 43' 8.4''$	O14	$65^{\circ} 59' 37''$
O5	$61^{\circ} 11' 10''$	O10	$69^{\circ} 42' 31.4''$	O15	$23^{\circ} 01' 47.3''$



Question (3) (15%)

Discuss in details

- 1- Global Positioning System (GPS)
- 2- GPS errors
- 3- GPS observations
- 4- Two types of Projections

Good Luck

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