Kurdistan Regional Government- Iraq University of Salahaddin – Hawler College of Engineering Civil Engineering Department Bologna Process	Final Exam-Fall Semester (2022 - 2023) Date: 15 / 12 / 2022 Time: **2** Hours Subject: Traffic Engineering Lecturer: *Dr. Aso Faiz Talabany*

Q.1: (25 Marks: 10 + 15)

A- The following two spot speed samples were conducted at a location to determine the effectiveness of improving geometrics at this location. Were the improvements effective in increasing average speeds at this location for **5**% significance level?

Item	Before	After
Average speed (kph)	**65.0**	**70.0**
Standard deviation (kph)	**10.0**	**10.0**
Sample size	**25**	**25**

B- Data was collected northbound and southbound for six runs along a section of **1000** m length of a two-way street during a course of moving vehicle method. The calculations showed that the average running speed of the test car was **45** kph both directions. There was no stopped time delay northbound direction while it was **1.5** minutes southbound direction. Calculate (for both directions) the travel speed, the running speed, and the flow rate of the traffic if the running speed of the traffic stream in northbound direction was equal to the travel speed of the test car and the running speed of the traffic stream is equal to the running speed of test car southbound direction. The difference between the overtaking and passed vehicles in both directions was **0** vehicles. Mn = Ms = **200** vehicles.

Q.2: (25 Marks: 10 + 15)

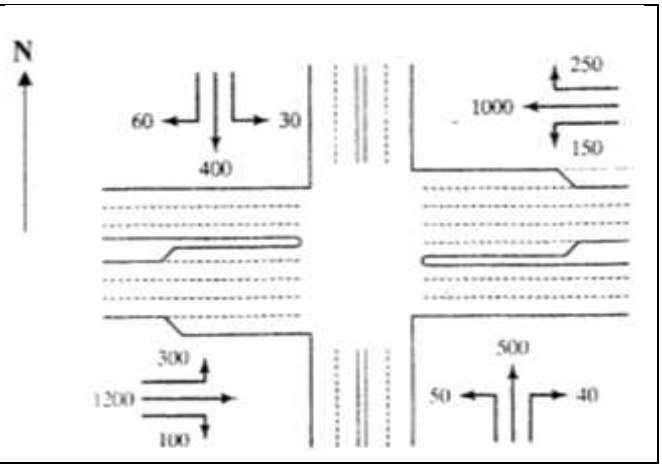
A- A control delay study was conducted on a two-lane approach of a signalized intersection started at **8:00** A.M. for **16** minutes. The sum of vehicle-in-queue count was **800** vehicles, the interval between vehicle-in-queue count was **15** seconds and the cycle length was **120** seconds. The number of vehicles arriving during the study period on this approach was **600** vehicles. The volume of left, right and through (straight) traffic are equal. The percentage of stopping vehicles are **50%** and the free flow speed was **50** mi/h. Using the HCM method, determine the level of service on this approach.

B- Two lanes of a **4-lane** one-way carriageway was closed for repairs. The maximum mean free speed under conditions of low flow in the **4-lane** position is **70** kph and in the bottleneck is **60** kph. The jam density is **100** vpk/lane. The volume of traffic on the **4-lane** road is **4000** vph. Assuming that the speed – density relation is linear, find:

1- The mean speed of traffic through the bottleneck caused by the closure of one lane
2- The mean speed of traffic clear of the bottleneck
3- The mean speed of traffic in the congested condition immediately on the approach to the bottleneck
4- The rate at which the queue of the congested traffic entering the bottleneck grows.
5- The density of traffic in the bottleneck

Q.3: (25 Marks)

Design isolated pretimed (fixed time) signal timing for the intersection shown in the following figure using the equivalent through-vehicle volume method.

Grades: North and south approaches are **3**% upgrades West and east approaches are **level** grades Moderate Pedestrian volumes 85%ile speed = **35** mi/h (N – S approaches) 15%ile speed = **35** mi/h (E – W approaches) Deceleration rate = **10** ft / s^2 Lane width = Median width = **12** ft	

Q.4: (25 Marks: 10+15)

A- parking study for **16**-hours of an area with **100** total legal parking spaces (stalls), reverted that there were **100** spaces available for **16**-hours, **60** spaces available for **14**-hours, **40** spaces available for **12**-hours, **20** spaces available for **10**-hours, **15** spaces available for **8**-hour. Determine the average parking duration, parking turnover rate and the parking supply if the number of vehicles parked for an observation interval of **0.25** hour are shown in the following table.

	Number of intervals parked						
	1	2	3	4	5	6	7
Totals	**300**	**250**	**120**	**100**	**60**	**40**	**20**

B- Use a contingency table to determine whether the difference in stop sign observance after the campaign was statistically significant at the **8**% level of significance. Assume that the outcome is independent of whether the observations are taken before or after the enforcement campaign. Results are summarized in the following table:

	Before	After
Stop	**50**	**60**
Near stop	**30**	**20**
No stop	**20**	**10**

Useful Equations and Tables:

$$d_1 = \frac{0.5C\left(1-\frac{g}{C}\right)^2}{1-\left[\min(1,X)\frac{g}{C}\right]}$$

$$d_2 = 900T\left[(X-1)+\sqrt{(X-1)^2+\frac{8klX}{cT}}\right]$$

LOS	**A**	**B**	**C**	**D**	**E**	**F**
Control Delay per Vehicle (sec/veh)	**≤10**	**>10-20**	**>20-35**	**>35-55**	**>55-80**	**>80**