No.: ELAINE TAN YEE LI Date:

CV4112 SEM1 15/16

Q1(a) Check variance - 2 samples (F test)

$v_1 = 31 - 1$

$= 30$

$v_2 = 41 - 1$

$= 40$

$H_0 : \sigma_0^2 = \sigma_1^2$

$H_1 : \sigma_0^2 \neq \sigma_1^2$

$\alpha = 10\%$ (2 tailed test) $\rightarrow \alpha/2 = 5\%$

$f_{0.05}(30, 40) = 1.74$

$f_{0.05}(40, 30) = 1/1.79$

$= 0.56$

$f_{obs} = \frac{S_1^2}{S_2^2}$

$= \frac{12.2^2}{10.8^2}$

$= 1.27$

Decision: failed to reject H_0

Conclusion: insufficient evidence to show that variance are significantly different.

$H_0 : \mu_0 - \mu_1 = 0$

$H_1 : \mu_0 - \mu_1 > 0$

$\alpha = 10\%$ (1 tailed test)

$v = 31 + 41 - 2$

$= 70$

$t_{critical} = 1.295$

$S_p^2 = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}$

$= \frac{30(12.2)^2 + 40(10.8)^2}{31 + 41 - 2}$

$S_p = 11.42$

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$$t_{obs} = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{S_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

$$= \frac{(76.8 - 72.2) - 0}{11.42 \sqrt{\frac{1}{31} + \frac{1}{41}}}$$

$$= 1.69$$

Decision : Reject H_0

Conclusion : The speed cameras is effective at 10% level of significance.

lower bound of the confidnce interval

$$= (\bar{x}_1 - \bar{x}_2) - t_{\alpha, \gamma = n_1 + n_2 - 2} \left(S_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}} \right)$$

$$= (76.8 - 72.2) - 1.295 \left(11.42 \sqrt{\frac{1}{31} + \frac{1}{41}} \right)$$

$$= 1.08$$

(b) Data collection ⇒ do not group all the roadusers together.

Data analysis ⇒ since $n > 30$, by central limit theorem, we can use 2- test.

Q2 (a) movement 9 - rank 2

$$V_{c,9} = 0.5 V_6 + V_5/N$$

$$= 0.5 (160) + 420/2$$

$$= 290 \text{ veh/h}$$

$$C_{p,9} = C_{m,9} = 671 \text{ veh/h}$$

movement 8 - rank 3

$$V_{c,8} = 0.5 V_6 + V_5 + 2V_4 + V_3 + V_2 + 2V_1$$

$$= 0.5 (160) + 420 + 2(55) + 55 + 290 + 2(45)$$

$$= 1045 \text{ veh/h}$$

$$C_{p,8} = 218 \text{ veh/h}$$

$$C_{m,8} = 0.95 \times 0.95 \times 218$$

$$= 197 \text{ veh/h}$$

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movement 7 - rank 4

$V_{c,7} = 2V_4 + V_5 + 0.5V_6 + 2V_1 + \frac{V_2}{N} + 0.5V_{11}$

$= 2(55) + 420 + 0.5(160) + 2(45) + 290/3 + 0.5(70)$

$= 880$ veh/h

$c_{p,7} = 238$ veh/h

$P'' = 0.95 \times 0.95 \times 0.62$

$= 0.56$

$P' = 0.65 \times 0.56 - \frac{0.56}{0.56+3} + 0.6\sqrt{0.56}$

$= 0.66$

$f_1 = 0.66 \times 1$ ← mvm 12 doesn't affect ∴ multilane

$= 0.66$

$c_{m,7} = 0.66 \times 238$

$= 157$ veh/h

$c_{SH} = \frac{85 + 75 + 40}{\frac{85}{157} + \frac{75}{197} + \frac{40}{671}}$

$= 203$ veh/h

(b) $d = \frac{3600}{203} + 900(0.25)\left[\frac{200}{203} - 1 + \sqrt{\left(\frac{200}{203} - 1\right)^2 + \frac{\frac{3600}{203}\left(\frac{200}{203}\right)}{450 \times 1.25}}\right] + 5$

$= 108$ s

∴ LOS F

Improvement - flare up for mvm 9

- slip road for mvm 9
- right turning pocket for mom 7

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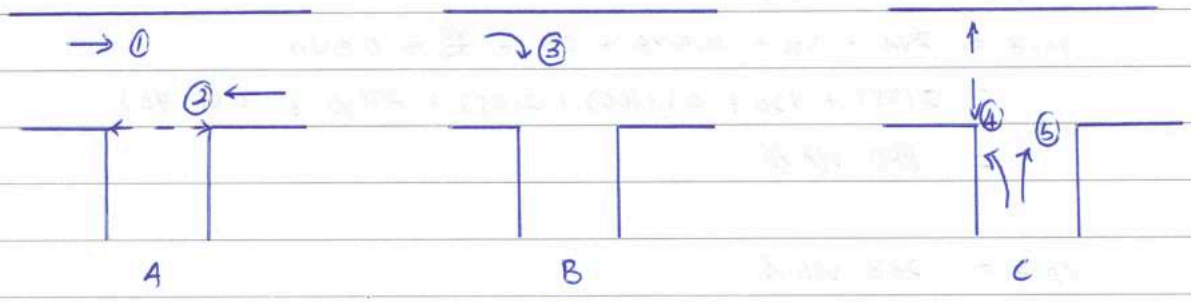
Q3



$S_1 = 525 \times 2 \times 3.4 = 3570$	$V_1 = 1010 \times 0.8 + 1010 \times 0.2 \times 1.56 = 1123$	$y_1 = 0.315$ ✓
$S_2 = 3570$	$V_2 = 950 \times 0.8 + 950 \times 0.2 \times 1.56 = 1056$	$y_2 = 0.296$
$S_3 = \frac{1800}{1 + \frac{1.52}{15}} = 1634$	$V_3 = 374 \times 0.8 + 374 \times 0.2 \times 1.56 = 415$	$y_3 = 0.254$ ✓
	$V_4 = 374 \times 0.8 + 374 \times 0.2 \times 1.56 = 415$	$y_4 = 0.289$ ✓
$S_4 = \frac{1800}{1 + \frac{1.52}{6}} = 1436$	$V_5 = 410 \times 0.8 + 410 \times 0.2 \times 1.56 = 455$	$y_5 = 0.278$
$S_5 = 1634$		

$$L = n\ell + \sum_{i=1}^{n} R_i$$
$$= 3(2) + 3(1)$$
$$= 9s$$

$$C_0 = \frac{1.5(9) + 5}{1 - 0.315 - 0.254 - 0.289}$$
$$= 130.28$$
$$\approx 135s$$

$$EG = 135 - 3(4-1) - 3(1)$$
$$= 123s$$

$$G_A = 123 \times \frac{0.315}{0.858}$$
$$= 45s \quad > 28s \quad \therefore \text{OK!}$$

$$G_B = 123 \times \frac{0.254}{0.858}$$
$$= 36s$$

$$G_C = 123 \times \frac{0.289}{0.858}$$
$$= 41s \quad > 28s \quad \therefore \text{OK!}$$

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Q4(a) $FFS = BFFS - f_{LW} - f_{LC} - f_N - f_{ID}$

$= 110 - 0 - 0 - 4.8 - 9.2$

$= 96 \text{ km/h}$

$$v_p = \frac{V}{PHF \times N \times f_{HV} \times f_p}$$

v_p / 2280 ; PHF / 0.9 ; N / 3 ; f_p / 1

$$f_{HV} = \frac{1}{1 + 0.15(2-1)}$$

$= 0.87$

$V = 2280 \times 0.9 \times 3 \times 0.87 \times 1$

$= 5355 \text{ veh/h}$

(b) $FFS = BFFS - f_{LW} - f_{LC} - f_N - f_{ID}$

$= 110 - 5.6 - 0 - 2.4 - 9.2$

$= 92.8 \text{ km/h}$

$$v_p = \frac{V}{PHF \times N \times f_{HV} \times f_p}$$

PHF / 0.9 ; N / 4 ; f_{HV} / 0.87 ; f_p / 1

$V = 2264 \times 0.9 \times 4 \times 0.87 \times 1$

$= 7090 \text{ veh/h}$

Increase in capacity $= 7090 - 5355$

$= 1735 \text{ veh/h}$

Increase no of lane, decrease lane width

↳ easier to have collision / accident

↳ need to provide sufficient side distance

↳ lane width still within the limit 3m

∴ worth !!

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Q5(a)(i) $\lambda = 8$

$\mu = 60/5$

$= 12$

$\rho = 8/12$

$= 0.67$

(ii) $w = \frac{1}{\mu - \lambda}$

$= \frac{1}{12 - 8}$

$= 0.25$

Average time of waiting $= 25\% \times 60$

$= 15$ mins

(iii) $P(n) = 0.3$

(b) - Parking planning standard

⇒ new development has to look after its own parking demand.

⇒ if the development has parking deficiency, it cause problem to the surrounding area.

- Parking geometric standard

⇒ sufficient headroom, turning radius etc for car park.

⇒ if the turning radius is too small, driver may feel hard to park their vehicle and hence refuse to use such car park.

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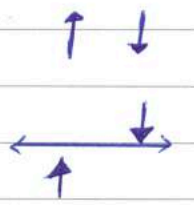
Travel demand management

- ↓ no. of car park available in the city or ↑ the price of the car park, it discourage driver to park in the city.

Q6(a)



Phase 1

Phase 2

cycle time = 70 s

SGM = 6 s

Amber + All red = 5 s

FGM = $\frac{11 + 11 + 1}{1}$ = 23 s

Veh Green	Amber + All Red	Veh Red	
36	5	29	
Pedestrian Red man		PSGM	PFGM
41		6	23

cycle time = 100 s

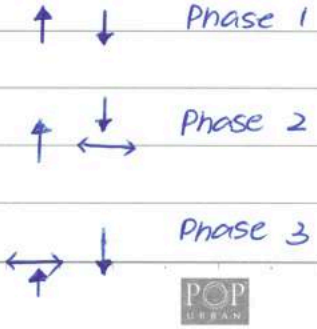
SGM = 65

Amber + All red = 5s

FGM = $\frac{15 + 15 + 3}{1}$ = 33 s

Veh Green	Amber + All Red	Veh Red	
56	5	39	
Pedestrian Red man		PSGM	PFGM
61		6	33

or do the two stage crossing's calculation



Phase 1

Phase 2

Phase 3

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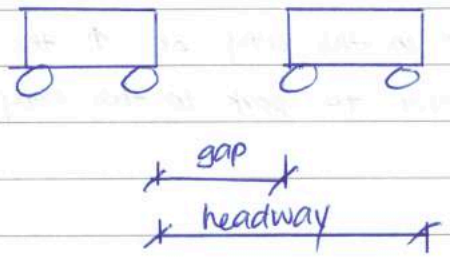
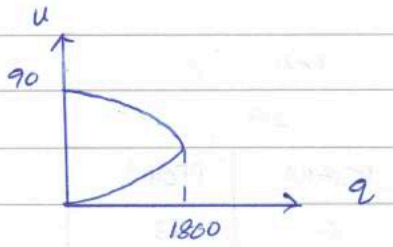
(b)



$$z = \frac{1}{h}$$
$$= 1800 \text{ veh/h}$$

$$q = uk$$
$$1800 = 90K$$
$$K = 20$$



with automobile, the nose of the u-q curve will be increase. Hence, increase capacity.