Promplem 1.

Q(a) $\log(\frac{p}{1-p}) = 5.2 + (-0.008)650 = 5.2-5.2=0$

$\Rightarrow \frac{p}{1-p} = e^0 \Rightarrow p = 0.5$

(b) $\log(\frac{p}{1-p}) = 5.2 - 0.008 \cdot 750 = -0.8$

$\Rightarrow \frac{p}{1-p} = e^{-0.8} \approx 0.4493 \Rightarrow p \approx 0.31$

1(c) when $p = 0.5$, $\log\frac{p}{1-p} = 0$, from (a) we know credit score of 650.

1(d) β means for each 1 point increase in credit score, the log-odds of default decreases by 0.0008.

when credit score increase by 100 points, the odds of default are multiplied by approximately 0.449 ($e^{-0.8}$), meaning the odds of default decrease by about 55%

Problem 2.

a) $\log(E[\text{visits}|x]) = 5.5 + 0.12 \times 5 + 0.30 \times 0 = 6.1$

b) For each additional \$1000 spent on advertising, the expected number of web visits increases by approximately 12.75% ($e^{0.12}-1$), holding weekend status constant.

c) On weekends, the expected number of website visits is approximately 35% ($e^{0.30}-1$) higher than on weekdays, holding ad spending constant.

d) $\log(500) = 5.5 + 0.12 \cdot \text{Ad. spend} + 0.30 \cdot 0$

$\Rightarrow \text{Ad\_spend} = 0.7146/0.12 \approx 5.955$ (in thousands)

Problem 3

a) $\mu = (45+48+\dots 57)/10 = 52.2$ thousands users

$\sigma^2 = 15.96 \Rightarrow \sigma \approx 4.0$ thousands users

b)

Y_t	Y_{t-1}
48	45
50	48
49	50
52	49
54	52
53	54
56	53
58	56
57	58
($\mu = 51.67$)	($\mu = 53.00$)

$\Sigma (Y_t - 51.67)^2 = 128$

$\Sigma (Y_{t-1} - 53.00)^2 = 156$

Σ products $= 89.04$

$\rho(1) = 89.04 / \sqrt{128 \times 156} \approx 0.63$

c) Today's users count is positive correlated with yesterday's user, about 63% of the variation in today's users can be linearly explained by yesterday's users

d) Yes. ① $\rho = 0.63$. lag-1 autocorrelation shows that consecutive days are strongly related. Day 11 is likely to be similar to Day 10

② We can make a prediction by $E[Y_{11} | Y_{10}] = \mu + \rho(1) \times (Y_{10} - \mu)$

Problem 4

a) $MA_3(4) = (Y_3 + Y_4 + Y_5)/3 = (11+15+13)/3 = 39/3 = 13$ thousands visits

b) $MA_3(5) = (Y_3 + Y_4 + Y_5)/3 = 13$ thousands visits

c) $WMA(4) = 0.25 \times Y_3 + 0.50 \times Y_4 + 0.25 \times Y_5 = 13.5$ thousands visits.

d) weighted MA, observations enter / exit gradually, i.e. smooth transitions