Question 1

a) $\bar{x} = \frac{\sum x}{n} = \frac{67}{10} = 6,7$ ✓

$\bar{y} = \frac{\sum y}{n} = \frac{2745}{10} = 274,5$ ✓ (2)

b) $b = \frac{n\sum(xy) - \sum x \sum y}{n(\sum x^2) - (\sum x)^2}$

$= \frac{10(13472) - (67)(2745)}{10(553) - (67)^2}$ ✓✓

$= -47,2574$ ✓

$y - 274,5 = (-47,2574)(x - 6,7)$ ✓

$y = -47,2574x + 591,1246$ ✓ ✓ (6)

c) let $x = 0$

$y = R591124,60$ ✓ → Not valid → extrapolated data ✓

Can't base a new vehicles price based on prices of second hand vehicles (2)

10 marks

QUESTION 2

Total no of combinations = $9!$

a) (4 girls) _ _ _ _ _

prob girls together = $\frac{6!\,4!}{9!} = \frac{1}{21}$ (0,0476) either (3)

b) $p(\text{boys} \mid \text{girls}) = \frac{p(\text{boys and girls})}{p(\text{girls})}$

$= \frac{\frac{1}{63}}{\frac{1}{21}}$

$= \frac{1}{3}$ (0,3333) (4)

p(boys and girls) = (4 girls) (5 boys)

$= \frac{4!\,5!\,2!}{9!}$

$= \frac{1}{63}$

c) B G B G B G B G B cant start with girls

$p(\text{alt}) = \frac{5\times4\times4\times3\times3\times2\times2\times1\times1}{9!}$ (3)

$= \frac{2880}{9!}$

$= \frac{1}{126}$ (0,007937)

No of ways –

d) Two girls do sit next to each other

_ _ _ _ _ _ _ _ $8!\,2!$

No of ways don't sit next to each other $9! - 8!\,2!$

Prob don't sit next to each other = $\frac{9! - 8!\,2!}{9!}$ (4)

$= \frac{7}{9}$

0,7778

14 marks

Question 3

p get question correct $= \frac{1}{5}$ ✓

p gets question incorrect $= \frac{4}{5}$ ✓

$\binom{10}{5}\left(\frac{1}{5}\right)^5\left(\frac{4}{5}\right)^5 + \binom{10}{6}\left(\frac{1}{5}\right)^6\left(\frac{4}{5}\right)^4$ ✓✓

$= 0{,}0264241\ldots + 0{,}005505\ldots$ ✓✓

(10)

$= 0{,}0319$ ✓✓

10 marks

Question 4

a) $\dfrac{\binom{25}{3}\binom{30}{4}\binom{95}{3}}{\binom{150}{10}}$ ✓✓✓✓

(5)

$= 0{,}0074683\ldots$

$= 0{,}0075$ ✓

b) $1 - \left[\dfrac{\binom{25}{0}\binom{125}{10}}{\binom{150}{10}} + \dfrac{\binom{25}{1}\binom{125}{9}}{\binom{150}{10}}\right]$ ✓✓✓

$= 1 - (0{,}15165\ldots + 0{,}3268\ldots)$ ✓

(5)

10 marks

$= 1 - 0{,}47849\ldots$

$= 0{,}5215$ ✓

Question 5

a) $\int_0^4 kt(16-t^2)\,dt = 1$

$\int_0^4 (16kt - kt^3)\,dt = 1$

$\left[8kt^2 - \frac{1}{4}kt^4\right]_0^4 = 1$

$128k - \frac{1}{4} \times 256k - 0 = 1$

$128k - 64k = 1$

$64k = 1$

$k = 1/64$

(6)

b) $P = \int_0^1 \frac{1}{64}t(16-t^2)\,dt$

$= \frac{1}{64}\int_0^1 (16t - t^3)\,dt$

$= \frac{1}{64}\left[8t^2 - \frac{1}{4}t^4\right]_0^1$

$= \frac{1}{64}\left[8 - \frac{1}{4}\right]$

$= \frac{31}{256}$

0,1211

(5)

c) $\int_0^m \left(\frac{1}{64}t(16-t^2)\right)dt = 0,5$

$\int_0^m \frac{1}{4}t - \frac{1}{64}t^3\,dt = 0,5$

$\left[\frac{1}{8}t^2 - \frac{1}{256}t^4\right]_0^m = 0,5$

$\frac{1}{8}m^2 - \frac{1}{256}m^4 = 0,5$

$32m^2 - m^4 = 128$

$m^4 - 32m^2 + 128 = 0$

$(m^2 \quad)(m^2 \quad)$

$m^2 = 16 + 8\sqrt{2}$

$m = 5,226$ N/A

$m^2 = 16 - 8\sqrt{2}$

(5)

Question 6

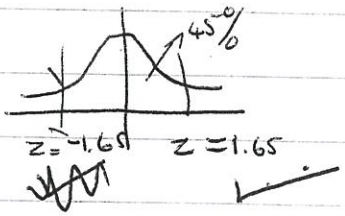
$$z = \frac{x - \mu}{\frac{\sigma}{\sqrt{n}}}$$

a) 1) $$x - \frac{z\sigma}{\sqrt{n}} < \mu < x + \frac{z\sigma}{\sqrt{n}} \qquad \frac{z\sigma}{\sqrt{n}} = x - \mu$$

$$200 - \frac{1.65 \times 65}{\sqrt{20}} < \mu < 200 + \frac{1.65 \times 65}{\sqrt{20}} \qquad \mu = x \pm \frac{z\sigma}{\sqrt{n}}$$

$$176,0182 < \mu < 223,9818$$

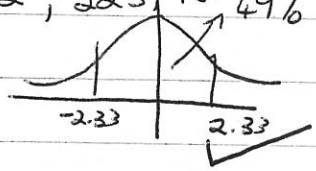
million million



(6)

2) pop mean: μ

μ lies in interval [176,0182 ; 223,9818] with a 90% confidence (2)



b) $$\hat{p} = \frac{22}{600} \qquad \hat{q} = \frac{578}{600}$$

$$\hat{p} - z\sqrt{\frac{\hat{p}\hat{q}}{n}} < p < \hat{p} + z\sqrt{\frac{\hat{p}\hat{q}}{n}}$$

$$\frac{22}{600} - 2.33\sqrt{\frac{\frac{22}{600} \times \frac{578}{600}}{600}} < p < \frac{22}{600} + 2.33\sqrt{\frac{\frac{22}{600} \times \frac{578}{600}}{600}}$$

(5)

$$0,01883 < p < 0,0565$$

2) width ≤ 0.08

$$2.33\sqrt{\frac{\frac{22}{600} \times \frac{578}{600}}{n}} \leq 0.04$$

$$\sqrt{\frac{\frac{3179}{90000}}{n}} \leq \frac{4}{233}$$

(5)

$$\frac{\frac{3179}{90000}}{n} \leq \frac{16}{54289}$$

$$\frac{3179}{90000} \leq 16n$$

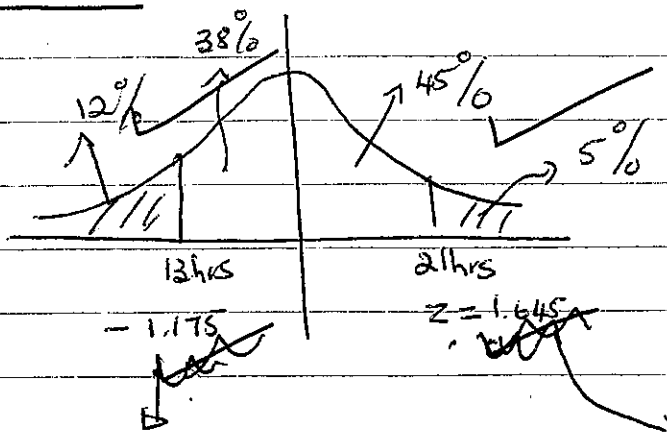
$$\frac{\frac{3179}{90000}}{16} \leq n \qquad n \geq 119,85$$

$\therefore n \geq 120$ times

18 mark

Question 7

1)



$z = \frac{x-\mu}{\sigma}$

2) $-1.175 = \frac{x-\mu}{\sigma}$ ✓

$-1.175 = \frac{13-\mu}{\sigma}$ ✓

$-1.175\sigma = 13 - \mu$

$\mu = 13 + 1.175\sigma$ ✓

$1.645 = \frac{x-\mu}{\sigma}$ ✓

$1.645 = \frac{21-\mu}{\sigma}$ ✓

$1.645\sigma = 21 - \mu$ ✓

$\mu = 21 - 1.645\sigma$

$\therefore \quad 21 - 1.645\sigma = 13 + 1.175\sigma$

$8 = 2.82\sigma$ ✓

$2.8369 = \sigma$ ✓

(10)

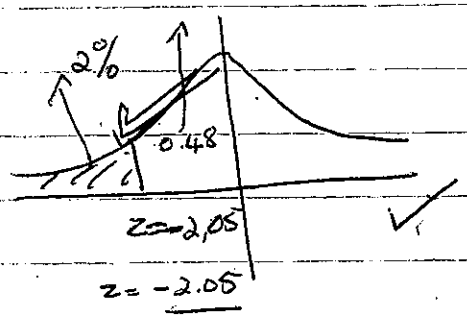
$\mu = 13 + 1.175 \times 2.8369$

$= 16,3334$ ✓✓

Question 8

H_0: $\mu = 85,6$ ✓✓

H_1: $\mu < 85,6$ ✓✓



✓

Test stat $z = \dfrac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$

$= \dfrac{80,4 - 85.6}{\frac{15.5}{\sqrt{25}}}$ ✓

$= -1,6774$ ✓

There is insufficient data to support the claim that the new medication has reduced the patients blood pressure. ✓✓

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