Sai Nikhil
thirandas.s@northeastern.edu
NUID: 001564864

1. A) P(Type B or Type O) = P(Type B) + P(Type O) as types of blood are mutually exclusive

$= 0.13 + 0.44 = 0.57$

B) P(Husband has Type A and wife has Type B) = P(Husband has Type A) × P(wife has Type B)
as both are independent events

$= (0.37) \times (0.13)$

$= 0.0481$

2. i) P(Student answering No) = P(Never cheated) × P(tail)

40% of students cheated ⇒ 60% of students never cheated.

P(Student answering No) $= (0.6) \times (0.5) = 0.3$

ii) P(Student answering Yes) = 1 − P(Student answering No)

$= 1 - 0.3 = 0.7$

P(Student Never Cheated & Answering Yes) = P(Never Cheated) × P(answering Yes)

$= (0.6) \times (0.7)$

$= 0.42$

iii) Student Never Cheated & Answering Yes are independent events

$P\left(\frac{\text{Student Never Cheated}}{\text{Answering Yes}}\right) = P(\text{Student Never Cheated})$

$= 0.6$

3. 12) a) P(Donot exercise regularly) = 0.58

Sample size = 12

Mean number of individuals per sample who don't exercise regularly $= np = (12) \times (0.58) = 6.96$

Standard deviation $\sigma = \sqrt{np(1-p)} = \sqrt{(12)(0.58)(1-0.58)}$

$= \sqrt{2.9232}$

$= 1.709$

12) b) Sample size = 12

10 of them do not exercise regularly

Probability of obtained results as bad or as worse = $P(X \geq 10)$

$$P(X \geq 10) = P(X=10) + P(X=11) + P(X=12)$$

$$= \binom{12}{10}(0.58)^{10}(1-0.58)^{12-10} + \binom{12}{11}(0.58)^{11}(1-0.58)^{12-11} + \binom{12}{12}(0.58)^{12}(1-0.58)^{12-12}$$

$$= 0.05015 + 0.01259 + 0.00145$$

$$= 0.064$$

16) P(child dies during his or her first year of life) = 0.0085 → Rare event

Distribution of rare events = Poisson distribution

a) Group size = 2000

Mean number of infants who die in a group of 2000 = $np = (2000)(0.0085)$

$$\lambda = 17$$

b) Probability that atmost 5 infants out of 2000 die = $P(X \leq 5)$

$$P(X \leq 5) = P(X=0) + P(X=1) + P(X=2) + P(X=3) + P(X=4) + P(X=5)$$

$$= \frac{e^{-17}(17)^0}{0!} + \frac{e^{-17}(17)^1}{1!} + \frac{e^{-17}(17)^2}{2!} + \frac{e^{-17}(17)^3}{3!} + \frac{e^{-17}(17)^4}{4!} + \frac{e^{-17}(17)^5}{5!}$$

$$= \cancel{e^{-17}(1508598)}\ e^{-17}(16293.51) = 0.00067$$

c) Prob that between 15 & 20 infants die = $P(15 \leq X \leq 20)$

$$P(15 \leq X \leq 20) = P(X=15) + P(X=16) + P(X=17) + P(X=18) + P(X=19) + P(X=20)$$

$$= \frac{e^{-17}(17)^{15}}{15!} + \frac{e^{-17}(17)^{16}}{16!} + \frac{e^{-17}(17)^{17}}{17!} + \frac{e^{-17}(17)^{18}}{18!} + \frac{e^{-17}(17)^{19}}{19!} + \frac{e^{-17}(17)^{20}}{20!}$$

$$\cancel{= 0.0906 + (0.09628 \times 2) + 0.0909 +}$$

$$= 0.0906 + 0.09628 + 0.09628 + 0.0909 + 0.0814 + 0.06915$$

$$= 0.52461$$

19) $\mu = 172.2$ lbs , $\sigma = 29.8$ lbs

a) P(weight less than 130 lbs) = Calculate z for 130 lbs

$$z = \frac{x-\mu}{\sigma} = \frac{130-172.2}{29.8} = -1.4161$$

$P(z < -1.4161) = 0.078$

b) z for 210 lbs . $z = \frac{x-\mu}{\sigma} = \frac{210-172.2}{29.8} = 1.268$

P(wt more than 210 lbs) = $P(z > 1.268) = 0.102$

c) P(wt less than 130 lbs or wt more than 210 lbs) =

P(wt less than 130 lbs) + P(wt more than 210 lbs)

$= 0.078 + 0.102 = 0.18$

P(Atleast 1 male with wt < 130. or wt > 210) $= 1-(1-0.18)^5 = 0.629$ ~~= 1 - (1 - (0.18)^5) = 0.9998~~

4. a) $P(987 < z < 1032.6) = P(z < 1032.6) - P(z > 987)$

= [pchisq (q = 1032.6 , df = 1000 , lower.tail = TRUE)] −

[pchisq (q = 987, df = 1000, lower.tail = TRUE)]

= 0.76915 − 0.39087 = 0.378

b) Using Normal approximation:

~~P(~~ [pnorm (q = 1032.6 , mean = 1000 , sd = sqrt(2x1000), lower.tail = TRUE)] −

[pnorm (q = 987, mean = 1000 , sd = sqrt(2x1000) , lower.tail = TRUE)]

= 0.7669 − 0.3856 = 0.3813.

5. a) $W = X + Y \Rightarrow X$ & Y are independent events. X is bironuinal distribution
Y is Poisson distribution

Mean(W) = Mean(X) + Mean(Y) $= np + 2$

$= (20)(0.2) + 2 = 2.4$

Var(W) = Var(X) + Var(Y) $= np(1-p) + 2$

$= (20)(0.2)(0.98) + 2 = 2.392$

b) Prob(W=1) = P(X=0, Y=1) + P(X=1, Y=0)

Prob_W1 = [dbinom(x=0, size=20, prob=0.02) * dpois(x=1, lambda=2)] +

[dbinom(x=1, size=20, prob=0.02) * dpois(x=0, lambda=2)]

= 0.1807 + 0.0368 = 0.2175

c) Using Normal Approximation:

std_x = sqrt(2.392)

~~P(W=1) ≈ Prob_Nor~~

Prob_Normal_W1 = [pnorm(q=1.5, mean=2.4, sd=std_x)] −

[pnorm(q=0.5, mean=2.4, sd=std_x)]

= 0.2803 − 0.1096 = 0.1707