ASSIGNMENT 2 PART II

Note: Your submission will consist of two steps. First, use the answer-area to provide a statement to the TA alerting them that a PDF document containing your answers to this assignment's Part II questions has been submitted (via document sharing discussed next). Second, use the shared-documents tool within MyStatLab to upload your PDF document. Do not forget to include a statement of academic integrity within the statement that you provide in the answer area to part II. Finally, note that you are required to show your work for full credit --- correct numeric answers may earn you little credit unless you show your work.

QUESTION 1 [20 marks]

Your sister owns and operates a restaurant called Quiet Waters (QW) and seeks your help on Human Resource issues.

Depending on a number of factors the wait-staff requirements (number of waitresses and/or waiters) at a QW restaurant can be either ***low*** (4 people), or ***moderate*** (7 people), or ***peak*** (12 people).

QW has two wage levels for wait-staff: $20.5/hr for experienced staff; and $10.5/hr for inexperienced staff (less than two years experience).

Suppose that the flagship QW restaurant has a large pool of staff (1/5th of which are experienced), and that each person in this pool has an equal chance of being assigned a shift (regardless of wage level). Based on this information answer the following (**make sure to report units where appropriate**):

(a) What is the probability model for the number of experienced staff assuming a ***low*** staffing level (i.e., 4 wait staff used)? Specify the model and tabulate the possibilities and probabilities associated with that model **[2 mark].**

- **Binomial model because the number of trials is given and the question asks for the probability of success in each given number of trials from 0-4.**
- **1/5 of staffs (experienced) earn 20.5/hr.**
- **4/5 of staffs (non-experienced) earn 10.5/hr**

P(x) = (n! / x! (n-x)!) * p^x*((1-p)^(n-x))

Staff level (x)	Pr[x]
0	.410
1	.410
2	.154
3	0.026
4	0.002

(b) What is the probability model for the total per hour wage assuming a ***low*** staffing level (i.e., 4 wait staff used) **[2 marks]**;

- **Poisson probability model due to the number of arrivals in a set**

period of time.

(c) Compute the following summaries for the probability model for total wage described in part (b) above (***low*** case, only) **[3 marks]**

i. **Expected value**

1/5*20.5hr +3/5*10.5hr=12.5/hr.

E(x)=n*p=4(12.5/hr)=50/hr

ii. **Variance, and**

Var[x] = n*p (1-p) =(10)^2)*(0.64) = (100)*(0.64)= 64

SD[x] = sqrt (Var[x]) = 8

iii. **Coefficient of variation**; SD[x] / Var[x] = 8 / 64 = 0.125

(d) Compute the following (total wage) summaries for ***moderate*** and ***peak*** cases as well **[3 marks]**.

i. **Expected value**

(moderate)

TW/h = 10x + 73.5

E(x) = n*p = 7 * 1/5 = 1.4

Var[x] = (10)^2 * (1.12)=(100) * (1.12)=112

Expected value: E[TW/h] = 10 (1.4) + 73.5 = 14 + 73.5 = 87.5

(Peak)

TW/h = 10x + 126

E[x] = n*p = 12 * 1/5 = 2.4

Var[x] = n*p (1-p) = 12 * 0.8 (1- 0.8) = 1.92

E[TW/h] = 10 (2.4) + 126= 24 + 126= 150

ii. **Variance, and**

(moderate)

Var[x] = Var[x] = (10)^2 * (1.12)=(100) * (1.12)=112

SD[x] = sqrt (Var[x]) = 10.58

(Peak)

Var[x] = (10)^2 * (1.92)=(100) * (1.92)=192

SD[x] = sqrt (Var[x]) = 13.86

iii. **Coefficient of variation**;

(moderate)

SD[x] / Var[x] = 10.58 / 112 = .0945

(Peak)

SD[x] / Var[x] = 13.86 / 192 = .072

(e) Your sister examined staffing patterns across a large, and equal, number of **low** (4 staff) versus **peak** (12 staff) shifts and noticed something interesting. She has been particularly interested in shifts that have no experienced staff on the floor; referred to as "fragile shifts" because the staff (inexperienced) is less able to react to challenges--- for a low-shift, a fragile-shift refers to the event of having 0

experienced workers out of 4, whereas for a peak-shift a fragile shift refers to the

event of having 0 experienced workers out of 12. Your sister notes that fragile-shifts happen roughly 6 times (see her graph below) more often on low-shifts than on peak-shifts. Noting that the junior manager is always in charge on "low-shifts" your sister suspects that the junior-manager may be to blame for the excess "fragile-shifts" --- she speculates that experienced staff avoid working when they know the junior manager will be in charge. Provide an alternative explanation, possibly exploiting some calculations and/or information from above **[4 marks]**

X=6
n=12
P= 25/400=0.0625 for peak shift
P=175/400=0.44 for low shift

(Peak shift)P(X=K=6) = [12] 0.0625^6*(1-0.0625) ^6=924*0.0625^6*(1-0.0625) ^6=0.000037
(Low shift) P(X=K=6) = [12] 0.44^6*(1-0.44) ^6=924*0.44^6*(1-0.44) ^6=0.207
Therefore, P(peak shift)<P(low shift) that aligns with the case of low–shift excess stated in question. The chances for experinced staff in comparison to inexperienced staff since they compose only 1/5 of the overall staff.

(f) How would your answers to question (d) change if the wage rates for wait-staff were increased by 25 percent (multiplied by 1.25). Provide numeric answer for the **moderate** case. *Be sure to address expected value, variance and coefficient of variation.* **[3 marks].**

a = 1.25
E[ax] = aE[x]
SD[ax] = aSD[x]
E[TW/h] = (87.5)*(a)=(87.5) * (1.25)= 109.38
SD[TW/h] = (10.58) * (a)= (10.58) * (1.25)= 13.56
SD[x] / Var[x] = 13.56 / 13.56^2 = 0.0737

(g) How would your answers to question (d) change if you were instructed to include the manager's hourly wage (manager has a fixed hourly rate of $32/hour). Provide numeric answer for the **moderate** case. *Be sure to address expected value, variance and coefficient of variation.* **[3 marks].**

Let y be the fixed hourly rate of 32
E[x + c] = E[x] + y
SD[x + c] = SD[x]
E[TW/h] = + y= 87.5 + 32= 119.5
SD[TW/h] = 10.58
Coefficient of Variation:SD[x] / Var[x] = 10.58 / 10.58^2 = .0945

[THERE ARE NO OTHER QUESTIONS]

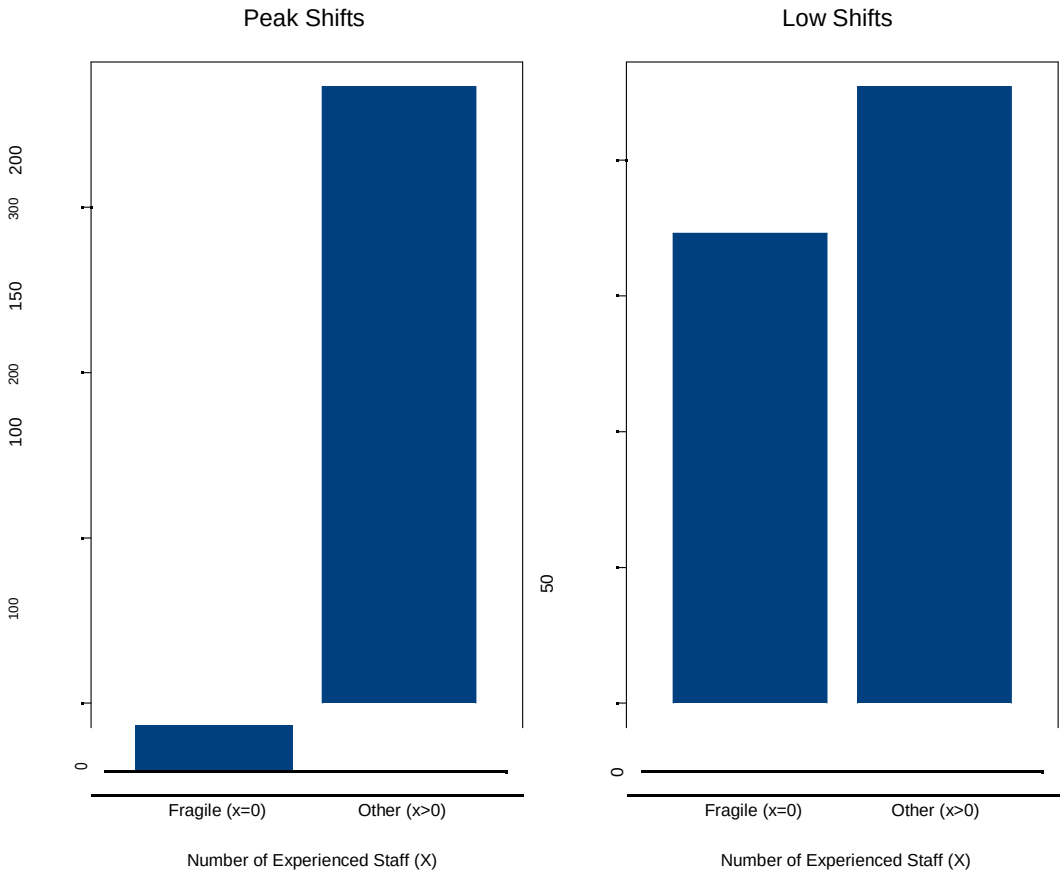

Figure 1: Your sister had data from 400 peak shifts and 400 low shifts. She computed the number of "fragile" shifts (x=0) among the peak and then among the low shifts, producing the barcharts in this figure. Note that peak shifts (total staff, n=12) and low shifts (total staff, n=4)