Week 8 Tutorial Question Solutions

Exposed to Risk past paper questions

Q1 (Jan 2021)

(a) rate of penalties per person hour = {number penalties} / {exposed to risk in hours}

number penalties = 200/50 = 4

use the Census method to approximate exposed to risk.

London – Milton Keynes	139 people x 30 minutes = 4170 minutes
Milton K – Stoke on T	(139+33-29) x 58 = 8294
Stoke on T – Stockport	(143+17-3) x 28 = 4396
Stockport – Manchester	(157+7-2) x 11 = 1782

total exposed to risk = 18642 minutes

rate per person hour = 4 / (18642/60) = 0.012874

(b) assumptions:
- the calculation itself is precise, it is the application of the rate to any analysis that requires assumptions
- if all 4 penalty people travelling together, or
- if all 4 penalties issued in same part of the journey
- then smoothed rate across the journey has less meaning

Q2 (May 2019)

Solution

First, we calculate the waiting time or exposed to risk in the ski lift queue

We can do this by exact calculation without a census approximation

Assume on average the first person gets to their ski lift chair after ½ x 12 = 6 seconds

Then each successive person waits a further 12 seconds

so, waiting time = 6 + (6 + 12) + (6 + 2x12) + …. + (6 + 49x12)

= 15,000 seconds

= 4.16 hours

therefore, rate of accepting drinks per person hour is 28 / 4.16 = 6.72

Q3 (IFoA 2015)

(i) A life alive at age x at time t should be included in the exposed-to-risk if and only if, were that life to die immediately, his or her death would be included in the deaths at age x, dx.

(ii) Those aged 22 last birthday on 30 June 2013 were born between 1 July 1990 and 30 June 1991, so half of them were born in 1990 and half in 1991.

Assuming that birthdays are evenly distributed across calendar years,

The number of persons aged 22 last birthday entering during each period is

10.00 – 11.30 p.m. 0.5(200 + 150) = 175

11.30 p.m. – 12.00 midnight 0.5(400 + 400) = 400

12.00 midnight – 1.00 a.m. 0.5(350 + 300) = 325

The number of persons aged 22 last birthday in the nightclub at 10.00 p.m., 11.30 p.m., 12.00 midnight, 1.00 a.m. and 2.00 a.m. is therefore

10.00 p.m. 0

11.30 p.m. 175

12 midnight 575

1.00 a.m. 900

2.00 a.m. 900

Using the census approximation and assuming that arrivals are evenly distributed across time, the exposed to risk in person-hours is

{1.5 x ½ (0 + 175)} + {0.5 x ½ (175 + 575)} + {1 x ½ (575+ 900)} +{1 x ½ (900 + 900)}

= 131.25 + 187.5 + 737.5 + 900

= 1,956.25

the so rate of requiring medical attention is

40 / 1,956.25 = 0.02045 per person hour.