

**Week 9 Practice Question – Statistical Tests**

Question 1

A life assurance company has been studying its recent mortality experience amongst policyholders in their 50s. It seeks to compare that experience with a mortality rates in a standard table and the relevant data is shown below.

Age	Exposed to Risk	Observed deaths	Standard table rate
50	4100	45	0.011
51	4555	54	0.012
52	4505	61	0.013
53	3900	59	0.015
54	3995	65	0.018
55	4250	71	0.022
56	3060	80	0.027
57	2465	90	0.035
58	2015	99	0.046
59	1680	105	0.058

- a. Perform a test of the overall adherence of the standard table rates to the observed data given the critical values of the  $\chi^2$  distribution at the 95% level in the second table below

Degrees of freedom	4	5	6	7	8	9	10
Critical value p	9.49	11.07	12.59	14.07	15.51	16.92	18.31

- b. List three possible problems using the standard table which the test in a. above would not detect.
- c. For each of the three defects listed in b. above give the name of another statistical test which would detect it.

## Question 2

A life assurance company has used the same standard mortality tables for annuity and term assurance policies for many years. An actuary who has recently joined the company is concerned this may not be appropriate. She compares the mortality rates given by the table with the company's experienced mortality for term assurance policyholders aged between 35 and 50. The table below gives the  $z_x$  values at each age.

age $x$	$z_x$
35	0.832
36	2.343
37	-0.599
38	-0.458
39	-0.791
40	2.228
41	-0.783
42	1.334
43	0.230
44	0.595
45	2.465
46	-1.529
47	0.436
48	-0.663
49	0.287
50	1.387

- (a) Why is the new actuary right to be concerned about the mortality table policy? [3]
- (b) Simply by looking at the  $z_x$  values what can be said about the term assurance mortality experience in this age range? [3]
- (c) Perform a test for the overall fit of the term assurance policyholder mortality to the standard table stating any assumptions you make? [9]
- (d) What conclusions can you draw from this test? [5]