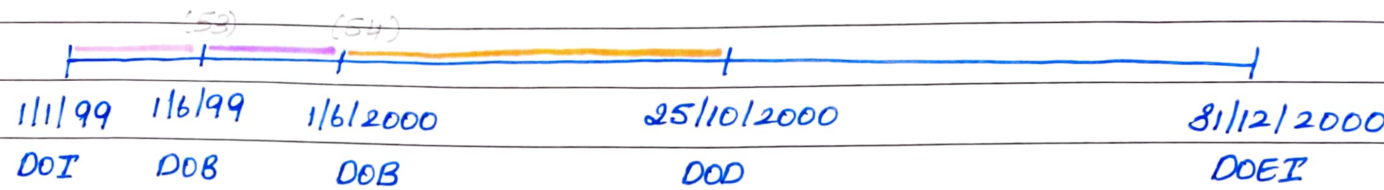
Date :................................

MON TUE WED THU FRI SAT SUN

2>



E^c_{52} = 1/1/99 - 31/5/99 = 151 days = 21.57 weeks

E^c_{53} = 1/6/99 - 31/5/2000 = 366 days = 52.29 weeks

E^c_{54} = 1/6/2000 - 25/10/2000 = 147 days = 21 weeks.

3> a> Left censoring.

Left censoring is when the event of interest has already occurred before the start of the investigation.

No, left censoring is not present.

b> Right censoring

Right censoring is when subject leaves the study before an event has occurred, or the study ends before the event has occurred.

No, right censoring is not present.

c> Interval censoring.

Interval censoring is when event falls within a certain bracket and the exact time is unknown.

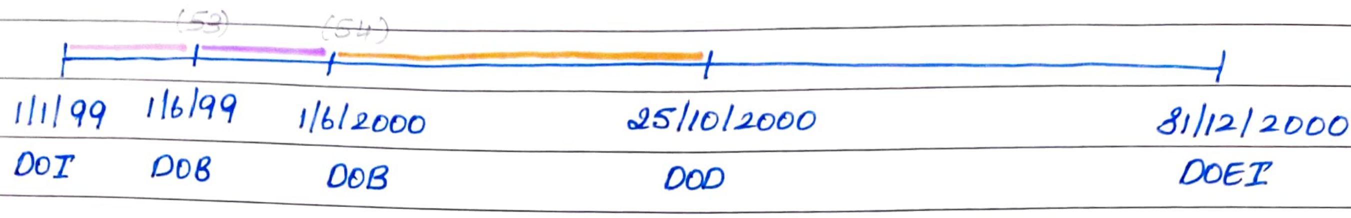
Yes interval censoring is present, since we do not know the exact date of surrender of policy.

d> Informative censoring

Informative censoring is when participants are lost to follow-up due to reasons related to the study.

Yes, informative censoring is present since we do not know the reason for policy surrender.

2)



E^c_{52} = 1/1/99 - 31/5/99 = 151 days = 21.57 weeks

E^c_{53} = 1/6/99 - 31/5/2000 = 366 days = 52.29 weeks

E^c_{54} = 1/6/2000 - 25/10/2000 = 147 days = 21 weeks.

3) a) Left censoring.

Left censoring is when the event of interest has already occurred before the start of the investigation.

No, left censoring is not present.

b) Right censoring

Right censoring is when subject leaves the study before an event has occurred, or the study ends before the event has occurred.

No, right censoring is not present.

c) Interval censoring.

Interval censoring is when event falls within a certain bracket and the exact time is unknown.

Yes interval censoring is present, since we do not know the exact date of surrender of policy.

d) Informative censoring

Informative censoring is when participants are lost to follow-up due to reasons related to the study.

Yes, informative censoring is present since we do not know the reason for policy surrender.

Date ....

MON TUE WED THU FRI SAT SUN

4) i) $f(T_x) = {}_tp_x \, \mu_{x+t}$

${}_tp_x$: person aged x will survive for at least t years.

μ_{x+t} : annual rate of transfer between alive and dead at exact age $x+t$.

ii) ${}_tp_x = e^{-\mu t}$

$= e^{-0.0325t}$

$q_{x+t} = 1 - p_{x+t} = 1 - e^{-0.0825}$

$P(K_x = t) = {}_tp_x \, q_{x+t}$

$= {}_tp_x \, (1 - p_{x+t})$

$= e^{-0.0825t} (1 - e^{-0.0825})$

$= e^{-0.0825t} (0.0319775507)$

$= 0.31978 \times e^{-0.0325t}$

iii) ${}_9p_{36} = e^{-\mu t}$

$= e^{-0.0325 \times 9}$

$= 0.74639$

iv)

Date :...............................

MON TUE WED THU FRI SAT SUN

5> i> 25-85 years of age.

ii>

6> a> y_i - 1: non-smoker else : 0

Z_i - 1: male 0 : female.

8> iii>

t_j	d_j	n_j	λ_j	$1-\lambda_j$	$S(t)=\prod_{t_j\le t}(1-\lambda_j)$
5	1	13	0.07692	0.92308	0.92308
7	1	12	0.08333	0.91667	0.84616
14	1	11	0.09091	0.90909	0.76923
28	1	~~10~~ 8	0.125	0.875	0.67308
35	1	5	0.2	0.8	0.53846

Range	$S(t)$
$0 \le t < 5$	1
$5 \le t < 7$	0.92308
$7 \le t < 14$	0.84616
$14 \le t < 28$	0.76923
$28 \le t < 35$	0.67308
$35 \le t$	0.53846

i> right censoring: patients beyond 45^{th} day mark were not studied as the observation had ended.

ii> informative censoring: cause of patients' death is unknown.

iv> at the 14^{th}, i.e., 2 week mark chances of survival are 76.923 % which is almost in line with the hospital's claim.

9> i>

Date : ....

MON TUE WED THU FRI SAT SUN

ii) $h(t) = h_0(t) \times e^{(\beta_F F + \beta_D D + \beta_M M)}$

iii) Baseline hazard function applies to policy which is:

- annual
- online
- direct debit.

~~$\exp[(\beta_F 0 + \beta_D x$~~

Condition 1 $= \exp[(\beta_F \times 0) + (\beta_D \times 1) + (\beta_M \times 0)]$
$= e^{\beta_D}$

$= \exp[(\beta_F \times 1) + (\beta_D \times 1) + (\beta_M \times 1)]$
$= e^{\beta_F + \beta_D + \beta_M}$

$e^{\beta_D} = e^{\beta_F + \beta_D + \beta_M} - 0.25(e^{\beta_F + \beta_D + \beta_M})$

Condition 2 $= \exp[(\beta_F \times 0) + (\beta_D \times 1) + (\beta_M \times 0)]$
$= e^{\beta_D}$

$= \exp[(\beta_F \times 1) + (\beta_D \times 0)]$
$= e^{\beta_F}$
$e^{\beta_D} = e^{\beta_F}$

Condition 3 $= \exp[(\beta_F \times 0) + (\beta_D \times 0) + (\beta_M \times 1)]$
$= e^{\beta_M}$

$= \exp[(\beta_F \times 0) + (\beta_D \times 2) + (\beta_M \times 0)]$
$e^{2\beta_D}$

$e^{\beta_M} = \frac{3}{4} \times e^{2\beta_D}$

Date: ....

MON TUE WED THU FRI SAT SUN

$e^{\beta_D} = e^{\beta_F}$ — ①

$e^{\beta_M} = \frac{3e^{2\beta_D}}{4}$ — ②

$e^{\beta_D} = e^{\beta_F + \beta_D + \beta_M} - 0.25(e^{\beta_F + \beta_D + \beta_M})$

$\cancel{e^{\beta_D} = e^{\beta_D + \beta_R + 3e^2}}$

①

$\beta_D = \beta_F$ — ③.

②

$\beta_M = \ln\left(\frac{3}{4}\right) + 2\beta_D$ — ④.

$$e^{\beta_D} = e^{\beta_D + \beta_D + [\ln(3/4) + 2\beta_D]} - 0.25\left[e^{\beta_D + \beta_D + [\ln(3/4) + 2\beta_D]}\right]$$

$$= e^{2\beta_D + \ln(3/4) + 2\beta_D} - 0.25\, e^{4\beta_D + \ln(3/4)}$$

$$= e^{4\beta_D + \ln(3/4)} - 0.25\, e^{4\beta_D + \ln(3/4)}$$

$$= 0.75\, e^{4\beta_D + \ln(3/5)}$$

$$= 0.75 e^{4\beta_D} + 0.75\, e^{\ln(3/4)}$$

$\ln(5e^5)$

$5 \quad e^5$

$0.25 e^{\beta_D} = 0.5625$

$e^{\beta_D} = 0.0225$

$e^{\beta_F} = 0.0225$ — ①.

$\cancel{e^{\beta_M} = \frac{3}{4}}$

$\beta_D = \ln(0.0225)$

$= -3.79424$

$\beta_F = -3.79424$ — ③.

$\beta_M = \ln\left(\frac{3}{4}\right) + 2(-3.79424)$ — ④.

$= -7.87616.$

Date :

MON TUE WED THU FRI SAT SUN

12) i) The Gompertz - Makeham law states that the human death rate is the sum of age dependant component which increases exponentially with age and an age - independent component.

ii)

iii) female non-smoker

iv) e female 0 male 1
non smoker 0 smoker 1

$e^{(\beta_1 \times 0 + \beta_2 \times 1)}$

$e^{(0.65)}$

1.91554

v) $e^{(\beta_2 \times 1}$

Date :..............................

MON TUE WED THU FRI SAT SUN

14) i) $h(t) = h_0(t) \exp[(\beta_1 \times w) + (\beta_2 \times x) + (\beta_3 \times y) + (\beta_4 \times z)]$

w 1 - service
0 - business
2 - housemaker
3 - social service

x 0 - female
1 - male

y 0 - non-metro
1 - metro

z

20-25	0
25-30	1
30-35	2
35-40	3

ii) $\exp[(-0.1 \times 3) + (0.3 \times 0) + (0 \times 1) + (-0.4 \times 3)]$

$\exp[-0.3 + 0 + 0 - 1.2]$

$e^{-1.5}$

0.22313

$\exp[(0.5 \times 0) + (0 \times 1) + (0.2 \times 0) + (0.7 \times 0)]$

$\exp[0 + 0 + 0 + 0]$

e^{0}

1

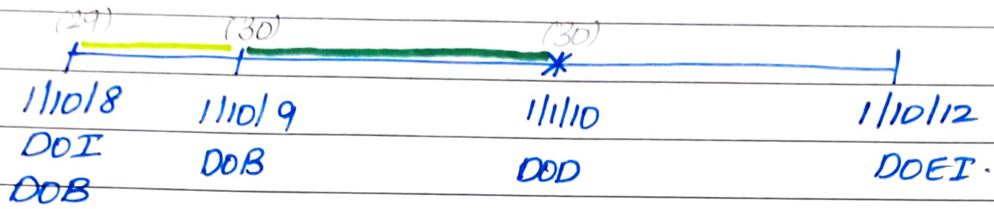
15)

Date :..................................

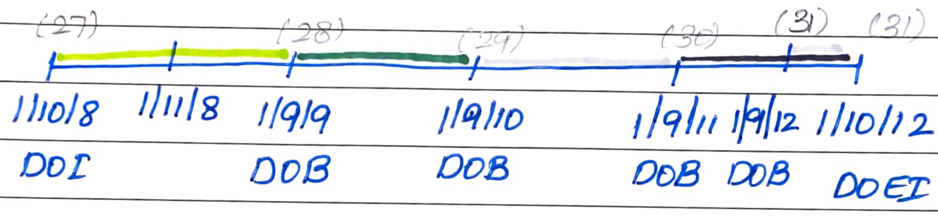
MON TUE WED THU FRI SAT SUN

15) i)

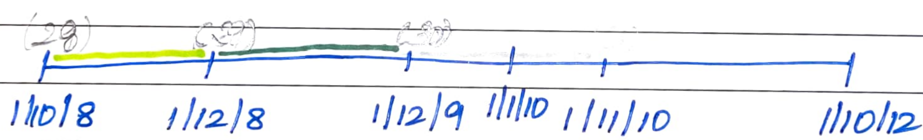
ii)



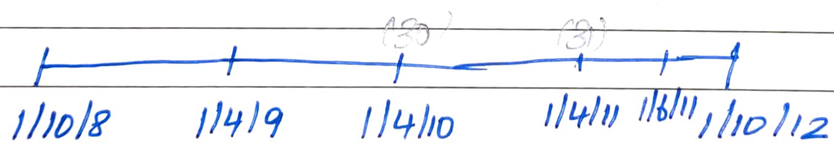
E^{c}_{30} = 1/10/9 − 1/1/10



E^{c}_{30} = 1/9/11 − ~~1/9/12~~ 31/8/12



E^{c}_{30} = ~~1/12/9~~ 1/1/10 − 1/11/10



E^{c}_{30} = 1/4/10 − 31/3/11

iii)