

Computational Statistics and Probability

Assignment 1
Finals

Section [0]

Khan, Moshirul Razzak
18-36303-1

(1)

(i) 2008, 2009, 2010

$$\text{3 years semi-total} = \frac{43}{4+7+51+64} + 51 + 64 \\ = 158$$

$$\text{Semi-average} = 158/2 = 79$$

(ii) 2011, 2012, 2013

$$\frac{76+81+96}{3} \\ = 253$$

$$\text{Semi-average} = 253/2 \\ = 126.5$$

$$\begin{aligned} \text{Trend values} &= 2008 - 79 - 15.8 = 63.2 \\ 2009 &- 63.2 + 15.8 = 79 \\ 2010 &- 79 + 15.8 = 94.8 \\ 2011 &- 94.8 + 15.8 = 110.6 \\ 2012 &- 110.6 + 15.8 = 126.4 \\ 2013 &- 126.4 + 15.8 = 142.2 \end{aligned}$$

Difference between the central years =

$$2012 - 2009 = 3$$

$$\Delta \text{ semi-averages} = 47.5$$

$$\text{Increase in trend for one year} = \frac{47.5}{3} \\ = 15.8$$

Years	2008	2009	2010	2011	2012	2013
Trend values	63.2	79	94.8	110.6	126.4	142.2

Ans

(2)

Years	Loans	3y semi-total	3y semi average
2004	40	-	-
2005	42	121	40.33
2006	39	106	35.33
2007	25	91	30.33
2008	27	103	34.33
2009	51	106	35.33
2010	28	105	35
2011	26	85	28.33
2012	31	87	29
2013	30	109	36.33
2014	48	-	-

S.No. 4

③

$$P = \begin{bmatrix} 0.6 & 0.4 \\ 0.0 & 0.2 \end{bmatrix}$$

$$\begin{aligned} P^2 &= \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \\ &= \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \end{aligned}$$

$$\begin{aligned} P^4 &= \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \\ &= \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix} \end{aligned}$$

$$\begin{aligned} P^5 &= \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 \\ 0.0 & 0.2 \end{bmatrix} \\ &= \begin{bmatrix} 0.66656 & 0.33344 \\ 0.66688 & 0.33312 \end{bmatrix} \end{aligned}$$

Probability of people entering the shop from 9-2pm = 0.66656 //

④ i) $P(T > 1\text{ min}) \approx P(T > 1) = e^{-\lambda t} = e^{-2 \times 1} = 0.1353$

ii) $P(T < 2) = P(\overline{T > 2}) =$

$$\begin{aligned} P(T < 2) &= -e^{-\lambda t} + 1 \\ &= 1 - e^{-4} \\ &= 0.9816 \end{aligned}$$

iii) $P(1 < T < 2)$

$$\begin{aligned} &= e^{-\lambda t_1} - e^{-\lambda t_2} \\ &= e^{-2} - e^{-4} \\ &= 0.117 \end{aligned}$$

Zubair Chowdhury

Serial : 6

19-H1241-2

Ans no 1

Trend value

Year	2008	2009	2010	2011	2012	2013
income	43	51	64	76	81	96

Year	Income	3 year total	3 year avg	Trend values
2008	43			$52.67 + 10.55 = 62.11$
2009	51	158	52.67	$62.11 + 10.55 = 72.67$
2010	64			$72.67 + 10.55 = 83.22$
2011	76			$83.22 + 10.55 = 93.77$
2012	81	253	84.33	$93.77 + 10.55 = 104.32$
2013	96			$104.32 + 10.55 = 114.87$

Difference between central years = 2012 - 2009 = 3

$$\text{Semi average} = \frac{84.33 - 52.67}{2} = 15.83$$

$$\text{increase in trend value} = \frac{31.66}{3} = 10.55$$

Ans no 3

The transition probability matrix

$$P = \begin{bmatrix} P_{00} & P_{01} \\ P_{10} & P_{11} \end{bmatrix} = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

We need P_{00} 's in P^5

$$P^2 = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

$$P^4 = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

$$= \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix}$$

$$P^5 = \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 0.66656 & 0.33344 \\ 0.66688 & 0.33312 \end{bmatrix}$$

Required probability is 0.66656

i) More than 1 minute

$$P(T > 1) = e^{-\pi t} = e^{-2 \times 1} = 0.1353$$

ii) less than 2 minute

$$\begin{aligned} P(T \leq 2) &= 1 - e^{-\pi t} \\ &= 1 - e^{-2 \times 2} \\ &= 1 - e^{-4} \\ &= 0.9816 \end{aligned}$$

iii) Between 1 to 2 minute

$$\begin{aligned} P(1 < T \leq 2) &= e^{-\pi t} - e^{-\pi t_2} \\ &= e^{-2 \times 1} - e^{-2 \times 2} \\ &= e^{-2} - e^{-4} \\ &= 0.1353 - 0.0183 \\ &= 0.117 \end{aligned}$$

Final Assignment = 01

Name: Joy Matlibber
ID: 20 - 41959-1

Serial: 07

Ans to the q no:- 01

Calculate the trend value using semi-averages method.

Year	2008	2009	2010	2011	2012	2013
Income (in crores)	43	51	64	76	81	96

Ans:

Year	Income	3-Year semi total	3-Year semi Avg	Trend values
2008	43			$52.67 - 10.55 = 42.11$
2009	51	158	52.67	$42.11 + 10.55 = 52.67$
2010	64			$52.67 + 10.55 = 63.22$
2011	76			$63.22 + 10.55 = 73.77$
2012	81	253	84.33	$73.77 + 10.55 = 84.32$
2013	96			$84.32 + 10.55 = 94.87$

NOW

Difference between the central years = $2012 - 2009 = 3$

Difference between the semi-averages = $84.33 - 52.67 = 31.66$

Increase in trend value for one year

$$= \frac{31.66}{3} \\ = 10.55$$

Jay Matubberz

ID: 26-41959-1

Serial = 07
Section = [5]

Ans No:-02

3-Year Moving Average.

Year	Loan Income	3-Year semi total	3-Year semi-average
2004	40	-----	-----
2005	42	121	40.33
2006	39	106	35.33
2007	28	91	30.33
2008	27	103	34.33
2009	51	106	35.33
2010	28	105	35
2011	26	85	28.33
2012	31	87	29
2013	30	109	36.33
2014	48	-----	-----

Ans No:-03

The transition probability Matrix:

$$P = \begin{bmatrix} P_{00} & P_{01} \\ P_{10} & P_{11} \end{bmatrix} = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}, \text{ We need } P_{00}^5, P_{11}^5$$

Now,

$$P^2 = P \times P = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \times \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

Now,

$$P^4 = P^2 \times P^2 = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \times \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$
$$= \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix}$$

And,

$$P^5 = P^4 \times P = \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix} \times \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$
$$= \begin{bmatrix} 0.66656 & 0.33344 \\ 0.66688 & 0.33312 \end{bmatrix}$$

So, The required probability is 0.66656 .

Ans No:-04

Let, T be the elapsed time between the entrance of $(n-1)^{\text{th}}$ and n^{th} signal.

And given poisson rate $\lambda = 2$ per minute

i) more than 1 minute,

$$P(T > 1) = e^{-at} = e^{-2 \times 1} = 0.1353$$

ii) less than 2 minutes.

$$P(T \leq 2) = 1 - e^{-2t}$$
$$= 1 - e^{-2 \times 2}$$

$$= 1 - e^{-4}$$
$$= 0.9816$$

iii) between 1 to 2 minutes,

$$P(1 < T < 2) = e^{-2t_1} - e^{-2t_2}$$
$$= e^{-2 \times 1} - e^{-2 \times 2}$$

$$= e^{-2} - e^{-4}$$
$$= 0.1353 - 0.0183$$

$$= 0.117$$

Jawad Mohammad
20-92006-1

Serial no: 08

Ans to Ques no 1

Year	Income	Yearly deviation	Year trend avg	Trend values
2008	43			$52.67 - 10.55 = 42.11$
2009	51	158	52.67	$42.11 + 10.55 = 52.67$
2010	64			$52.67 + 10.55 = 63.22$
2011	76			$63.22 + 10.55 = 73.77$
2012	81	253	84.33	$73.77 + 10.55 = 84.32$
2013	76			$84.32 + 10.55 = 94.87$

Now,

Difference between the central years = $2012 - 2007$

$$\begin{aligned} \text{Difference between the deviations} &= 3 \\ \text{Difference between the deviations} &= 84.33 - 52.67 \\ &= 31.66 \end{aligned}$$

$$\begin{aligned} \text{Increase in trend value for one year} &= \frac{31.66}{3} \\ &= 10.55 \end{aligned}$$

Ann to vnu no23 year ~~mean~~ Morning Avandge

Year	Loan	3 year Rent total	3 Year Rent avg
2004	40	1186 - 82	—
2005	92	121	40.73
2006	39	106	35.73
2007	25	71	30.33
2008	27	103	34.33
2009	51	106	35.73
2010	28	105	35
2011	26	85	28.33
2012	31	87	27
2013	26	107	36.33
2014	48	—	—

Ans to NMA 103

The transition probability matrix

$$P = \begin{bmatrix} P_{00} & P_{01} \\ P_{10} & P_{11} \end{bmatrix} = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

We need P^{05} in ps

$$P^2 = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

$$P^4 = P^2 \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

$$= \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix}$$

$$P^5 = \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 0.66656 & 0.33344 \\ 0.66698 & 0.33312 \end{bmatrix}$$

The probability is 0.66656

Ans.

An approximation

II more than 4 minutes

$$P(T > 4) = e^{-dt} = e^{-2 \times 1} = 0.1353$$

III less than 2 minutes

$$\begin{aligned} P(T < 2) &= 1 - e^{-dt} \\ &= 1 - e^{-2 \times 1} \\ &= 1 - e^{-4} \\ &= 0.9616 \end{aligned}$$

IV) between 4 to 2 minutes.

$$P(4 < T < 2) = e^{-dt_1} - e^{-dt_2}$$

$$= e^{-2 \times 1} - e^{-2 \times 2}$$

$$= 0.1353 - 0.9616 = 0.8263$$

ABU TAHER MAHIM SARKAR, ID: 20-42042-1, SL: 09

Ans-no-01

Year	Income	3 Years semi Total	3 Years semi Average	Trend value
2008	43			$52.667 - 10.555 = 42.112$
2009	51	158	52.667	$42.112 + 10.555 = 52.667$
2010	64			$52.667 + 10.555 = 63.222$
2011	76			$63.222 + 10.555 = 73.777$
2012	81	253	84.333	$73.777 + 10.555 = 84.332$
2013	96			$84.332 + 10.555 = 94.887$

Here,

$$\text{Difference between the central year} \\ = (2012 - 2009) = 3$$

Difference between the semi averages

$$= (84.333 - 52.667) = 31.666$$

Increase the trend value for one

$$\text{Year} = \frac{31.666}{3} = 10.555$$

Ans

Ans-no-02

Year	Income	3 Years semi Total	3 Years semi Average
2004	40	---	---
2005	42	121	40.333
2006	39	106	35.333
2007	25	91	30.333
2008	27	103	34.333
2009	51	106	35.333
2010	28	105	35
2011	26	85	28.333
2012	31	87	29
2013	30	109	36.333
2014	48	---	---

Ans

and not solar heat will increase.

Ans-no-03

The transition probability matrix.

$$P = \begin{bmatrix} P_{00} & P_{01} \\ P_{10} & P_{11} \end{bmatrix} = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

We need P_{00}^5 in P^5

$$\begin{aligned} P^2 &= \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \\ &= \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \end{aligned}$$

$$\begin{aligned} P^4 &= \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \\ &= \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix} \end{aligned}$$

$$\begin{aligned} P^5 &= \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \\ &= \begin{bmatrix} 0.66656 & 0.33344 \\ 0.66688 & 0.33312 \end{bmatrix} \end{aligned}$$

The required probability is 0.66656 [Ans]Ans-no-04Given, Poisson rate $\lambda = 2$ per minute.

i) $P(\text{more than 1 minute}) = P(T > 1)$
 $= e^{-\lambda t} = e^{-2 \times 1} = 0.13534$.

ii) $P(\text{less than 2 minutes}) = P(T < 2)$
 $= 1 - e^{-\lambda t} = 1 - e^{-2 \times 2} = 0.98168$.

iii) $P(\text{between 1 to 2 minutes}) = P(1 < T < 2)$
 $= e^{-\lambda t_1} - e^{-\lambda t_2} = e^{-2 \times 1} - e^{-2 \times 2}$
 $= 0.11702$ [Ans].

Final Assignment - 1

Rifath Bin Mashruzz, ID: 20-420791
serial: 10

- 1) Calculate the trend value using semi average method

Year	2008	2009	2010	2011	2012	2013
Income	43	51	64	76	81	96

Ans:

Year	Income	3 & years S.Avg	3-year cent Avg	Trend values
2008	43			$52.67 - 10.55 = 42.11$
2009	51	158	52.67	$42.11 + 10.55 = 52.67$
2010	64			$52.67 + 10.55 = 63.22$
2011	76		84.33	$63.22 + 10.55 = 73.77$
2012	81	253		$73.77 + 10.55 = 84.32$
2013	96			$84.32 + 10.35 = 94.82$

serial - 10

Here,

Difference between the central year
 $= (2012 - 2009) = 3$

Difference between the semi-averages.
 $= (84.333 - 52.667) = 31.666$

Increase the trend value for one
year $= \frac{31.666}{3} = 10.555$

(Any)

serial -10

2)

Year	Loan	3 Year semi total	3 year semi Average
2004	40	—	—
2005	42	121	40.333
2006	39	106	35.333
2007	25	91	30.333
2008	27	103	34.333
2009	51	106	35.333
2010	28	105	35
2011	26	85	28.333
2012	31	82	27
2013	30	109	36.333
2014	48	—	—

(Ans)

Ans to the Que No - 3

The transition Probability matrix,

$$P = \begin{bmatrix} P_{00} & P_{01} \\ P_{10} & P_{11} \end{bmatrix} = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

We need P_{00}^5 in P^5

$$P^2 = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \cdot \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

$$P^4 = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \cdot \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

$$= \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix}$$

$$P^5 = \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 0.66656 & 0.33344 \\ 0.66688 & 0.33312 \end{bmatrix}$$

The required probability is 0.66656

(Ans)

Ans to the Que No. 4

Given

Pairs per rate $\lambda = 2$ per minute

$$(i) P(\text{more than 1 minute}) = P(T > 1)$$

$$= e^{-2 \times 1} = e^{-2} = 0.13534$$

$$(ii) P(\text{less than 2 minutes}) = P(0 < T < 2)$$

$$= 1 - e^{-2 \times 2} = 1 - e^{-4} = 0.98168$$

$$(iii) P(\text{between } 1 \text{ to } 2 \text{ minutes}) = P(1 < T < 2)$$

$$= e^{-2 \times 1} - e^{-2 \times 2} = e^{-2} - e^{-4} = 0.11702$$

(Ans)

Name: Md. Altabur Rahman

ID #: 20-92107-1

Assignment - 1

Ans: 1

Year	Income	Semi total	semi Avg	Trend values
2008	93			$52.67 + 10.55 = 63.22$
2009	51	158	52.67	$63.22 + 10.55 = 73.77$
2010	69			$73.77 + 10.55 = 84.32$
2011	76			$84.32 + 10.55 = 94.87$
2012	81	253	84.33	
2013	96			

$$\text{Year difference} = 2012 - 2009 \\ = 3$$

$$\text{Semi Avg. difference} = 84.33 - 52.67 \\ = 31.65$$

$$\text{Trend value} = \frac{31.65}{3} \\ = 10.55$$

Ans. 2

Year	Loan	3-year semi total	3 year semi avg
2004	90	—	—
2005	92	121	40.33
2006	39	106	35.33
2007	25	91	30.33
2008	27	103	34.33
2009	51	106	35.33
2010	28	105	35
2011	26	85	28.33
2012	31	87	29
2013	30	109	36.33
2014	98	—	—

Ans. 3

The probability matrix

$$P = \begin{bmatrix} P_{00} & P_{01} \\ P_{10} & P_{11} \end{bmatrix} = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

We need P_{00}^5 in P^5

$$P^L = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} + \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 1.2 & 0.8 \\ 1.6 & 0.9 \end{bmatrix}$$

$$P^9 = \begin{bmatrix} 1.2 & 0.8 \\ 1.6 & 0.9 \end{bmatrix} + \begin{bmatrix} 1.2 & 0.8 \\ 1.6 & 0.9 \end{bmatrix}$$

$$= \begin{bmatrix} 2.4 & 1.6 \\ 3.2 & 0.8 \end{bmatrix}$$

$$P^5 = \begin{bmatrix} 2.4 & 1.6 \\ 3.2 & 0.8 \end{bmatrix} + \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 3 & 2 \\ 4 & 1 \end{bmatrix}$$

The required probability is 3.

Ans. 9

(i) more than one minute,

$$\begin{aligned} P(T > 1) &= e^{-\lambda t} \\ &= e^{-2} \\ &\approx 0.135 \end{aligned}$$

(ii) less than 2 minute

$$\begin{aligned} P(T < 2) &= 1 - e^{-\lambda t} \\ &= 1 - e^{-4} \\ &\approx 0.9816 \end{aligned}$$

(iii) between 1 to 2 minute,

$$\begin{aligned} P(1 < T < 2) &= e^{-\lambda t_1} - e^{-\lambda t_2} \\ &= e^{-2} - e^{-4} \\ &\approx 0.1353 - 0.0133 \\ &\approx 0.117 \end{aligned}$$

Final Assignment - 01

Name: Moon, Md. Mamunur Rahman
ID: 20-4243 9-1

Section: 0
Serial: 12

Problem- 01

Trend values using Semi-average method:

Year	Income	3-year semi-total	3-year semi-average	Trend values
2008	43			$52.66 - 10.56 = 42.1$
2009	51	158	52.66	$42.1 + 10.56 = 52.66$
2010	64			$52.66 + 10.56 = 63.22$
2011	76			$63.22 + 10.56 = 73.78$
2012	81	253	84.33	$73.78 + 10.56 = 84.34$
2013	96			$84.34 + 10.56 = 94.9$

Difference between central years = 2012 - 2009
= 3 years

Difference between the semi-averages,

$$= 84.33 - 52.66$$

$$= 31.67$$

Increase in trend value for 1-year,

$$\approx 31.67 / 3$$

$$= 10.56$$

Problem - 02

Year	Loan	3-year semi Total	3-year semi average
2004	40	—	—
2005	42	121	40.33
2006	39	106	35.33
2007	25	91	30.33
2008	27	103	34.33
2009	51	106	35.33
2010	28	105	35
2011	26	85	28.33
2012	31	87	29
2013	30	109	36.33
2014	48	—	—

$$33.22 - 22.18 =$$

$$52.18 =$$

Problem - 03 //

Given, Probability of,

(9-10) and (10-11) is 0.6

(10-11) is 0.8

∴ The probability of entering customers up to 2PM to 9 AM (starting) is at Stage - 05.

$$\therefore P = \begin{bmatrix} P_{00} & P_{01} \\ P_{10} & P_{11} \end{bmatrix} = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

$$\therefore P^5 = [P] \times [P] \times [P] \times [P] \times [P]$$

$$= \begin{bmatrix} 0.6665 & 0.3334 \\ 0.6668 & 0.3331 \end{bmatrix}$$

∴ The required probability is 0.6665 or 66.65 %

(Ans.)

Problem - 04

Given,

Poisson rate of email entering, $\lambda = 2$ per minute

Probability of elapsed time between the entrance of 10th and 11th mail is,

(i) more than 1 minute,

$$P(T > 1) = e^{-\lambda t} = e^{-(2 \times 1)} = 0.13533$$

(ii) less than 2 minutes,

~~$P(T < 0.5)$~~

$$\begin{aligned} P(T < 2) &= 1 - e^{-\lambda t} = 1 - e^{-(2 \times 2)} \\ &= 1 - 0.01831 \\ &= 0.98169 \end{aligned}$$

(iii) between 1 to 2 minutes,

$$\begin{aligned} P(1 < T < 2) &= e^{-\lambda t_1} - e^{-\lambda t_2} = e^{-(2 \times 1)} - e^{-(2 \times 2)} \\ &= (0.13533 - 0.01831) \\ &= 0.11702 \quad (\text{Ans.}) \end{aligned}$$

Zaid Amin Racofin

ID: 20-42459-1

Serial: 13

Ans. to the Q. No. 11 of 2011

Year	Income	1-year semi Total	2-Year semi Avg.	Total values
2008	43	2.0	12.9 09	52.67 - 10.55 = 42.11
2009	51	158 8.0	52.67 11.9 01.9	42.11 + 10.55 = 58.67
2010	64			52.67 + 10.55 = 63.22
2011	76			63.22 + 10.55 = 73.77
2012	81	253 9	84.33	73.77 + 10.55 = 84.32
2013	96	[1.0 2.0] [2.0 2.0] [3.0 8.0] [3.0 8.0]		84.32 + 10.55 = 94.87

Now, Difference between the central years

$$[52.67 \ 84.33] / 2012 - 2009 = 13$$

Difference between the semi-Average

$$[85.88 \ 84.33] / 2 = 1.66$$

$$85.88 - 84.33 = 1.66$$

$$= 31.66$$

Income trend value for One year

$$= \frac{31.66}{3} = 10.55$$

Ans to the Q.No. 3

The transition probability matrix

22.01	FD-S2	FD-S5	FD-F1	FD-F2	FD-F5
P_{11}	P_{01}	P_{10}	P_{00}	P_{11}	P_{00}
22.01 + F1.S2	FD-S2	22.01 + F1.S5	FD-S5	22.01 + F2.F1	FD-F1
$P_{10} = 22.01 + F1.S2$	$P_{01} = FD-S2$	$P_{11} = 22.01 + F1.S5$	$P_{00} = FD-S5$	$P_{11} = 22.01 + F2.F1$	$P_{00} = FD-F1$
22.01 + F2.F2	FF-F2	22.01 + FF-F2	FF-F5	22.01 + FF-F5	FF-F5
$P_{11} = 22.01 + F2.F2$	$P_{01} = FF-F2$	$P_{10} = 22.01 + FF-F2$	$P_{00} = FF-F5$	$P_{11} = 22.01 + FF-F5$	$P_{00} = FF-F5$
<u>We need</u> P_{00} in PS_{22}	P_{00}	P_{00}	P_{00}	P_{00}	P_{00}
$P_1 = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$	$P_2 = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$	$P_3 = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$	$P_4 = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$	$P_5 = \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix}$	$P_6 = \begin{bmatrix} 0.66656 & 0.33344 \\ 0.66688 & 0.33312 \end{bmatrix}$
$22.01 = \frac{P_6}{8}$	$22.01 = \frac{P_5}{8}$	$22.01 = \frac{P_4}{8}$	$22.01 = \frac{P_3}{8}$	$22.01 = \frac{P_2}{8}$	$22.01 = \frac{P_1}{8}$

$\begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$ *is required generatl*

$$P_4 = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \quad \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

approx - 1/8 = 0.0125 with required generatl

$$\begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix}$$

$$P_5 = \begin{bmatrix} 0.66656 & 0.33344 \\ 0.66688 & 0.33312 \end{bmatrix}$$

approx - 1/8 = 0.0125 with required generatl

$$22.01 = \frac{P_5}{8}$$

The required probability is 0.66656

[Ans]

Ans. to the Q. No. 4

i) more than 1 minute

$$P(T > 1) = e^{-\lambda t} = e^{-2 \times 1} = 0.1353$$

ii) less than 2 minutes

$$\begin{aligned} P(T < 2) &= 1 - e^{-\lambda t} \\ &= 1 - e^{-2 \times 2} \\ &= 0.9816 \end{aligned}$$

iii) Between 1 to 2 minutes

$$\begin{aligned} P(1 < T < 2) &= e^{-\lambda t_1} - e^{-\lambda t_2} \\ &= e^{-2 \times 1} - e^{-2 \times 2} \\ &= e^{-2} - e^{-4} \\ &= 0.117 \end{aligned}$$

Name:- Md. Toorvir Hossen
ID:- 20-42488-1

SL = 14

Ans to the Q. No.-1

Year	Income	3 Year semi total	3 Year semi Avg.	Trend Value
2008	43			$52.67 - 10.55 = 42.11$
2009	51	158	52.67	$42.11 + 10.55 = 52.67$
2010	64			$52.67 + 10.55 = 63.22$
2011	76			$63.22 + 10.55 = 73.77$
2012	81	253	84.33	$73.77 + 10.55 = 84.32$
2013	96			$84.32 + 10.55 = 94.87$

now,

Difference between the central Year :- 2012 - 2009
= 3

Difference between the semi-avg = $84.33 - 52.67$
= 31.66

∴ Increase in trend value for one year, $\frac{31.66}{3}$

$$\begin{bmatrix} 50000.0 & 55000.0 \\ 50000.0 & 55000.0 \end{bmatrix} = 10.55$$
$$\begin{bmatrix} 51555.0 & 52222.0 \\ 51555.0 & 52222.0 \end{bmatrix}$$

22222.0 is additional amount

Ans to the Q. No:- 2

3-Year Moving Average,

Year	Loan	3-Year Semi total	3-Year nomi average
2004	40	- - -	- - -
2005	42	22 + 12 +	40.33
2006	39	106	35.33
2007	25	71	30.73
2008	27	103	34.33
2009	51	106	35.33
2010	23	105	35
2011	26	85	28.33
2012	31	87	29
2013	30	109	36.33
2014	48	- - -	- - -

Ans to the Q.No:-03

The transition Probability matrix

$$P = \begin{bmatrix} P_{00} & P_{01} \\ P_{10} & P_{11} \end{bmatrix} = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

We need P_{00}^5 in P^5

$$P^2 = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

$$P^4 = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

$$= \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix}$$

$$P^5 = \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 0.66656 & 0.33344 \\ 0.66688 & 0.33312 \end{bmatrix}$$

The required probability is 0.66656

Ans to the Q.No:- 4 of m

i) more than 1 minutes,

$$P(T > 1) = e^{-\lambda t} = e^{-2 \times 1} = 0.1353.$$

" more than 2 minutes,

$$P(T > 2) = 1 - e^{-\lambda t} = 1 - e^{-4} = 0.98168.$$

ii) between 1 to 2 minute,

$$P(1 < T \leq 2) = e^{-\lambda t_1} - e^{-\lambda t_2} = e^{-2 \times 1} - e^{-2 \times 2} = 0.1353 - 0.0133 = 0.122.$$

$$= e^{-2} - e^{-4} = 0.1353 - 0.0133 = 0.122.$$

$$= 0.1333 - 0.0133 = 0.117.$$

$$= 0.117.$$

F.T Assignment

Name: Md. Shanjidul Islam Sadikin
 ID: 20-42621-1 serial: 15

Year	2008	2009	2010	2011	2012	2013
income (in crores)	43	51	64	76	81	96
Year	Income	3 year semi total	3 year semi average	Trends value		
2008	43			$52.67 - 10.553 = 42.057$		
2009	51	158	$\frac{158}{3} = 52.67$	$42.057 + 10.553 = 52.67$		
2010	64			$52.67 + 10.553 = 63.22$		
2011	76			$63.22 + 10.553 = 73.78$		
2012	81	253	$\frac{253}{3} = 84.33$	$73.78 + 10.553 = 84.33$		
2013	96			$84.33 + 10.553 = 94.88$		

Difference between central year.

$$2012 - 2009 = 3$$

Difference between semi-average

$$84.33 - 52.67 = 31.66$$

Increase in trend value for one year.

$$31.66 / 3 = 10.553$$

(2)

From given data values.

Year	Loan	3 years semi total	3 years semi average
2004	40	---	---
2005	42	121	40.33
2006	39	106	35.33
2007	25	91	30.33
2008	27	103	34.33
2009	51	106	35.33
2010	28	105	35
2011	26	85	28.33
2012	31	87	29
2013	30	109	36.33
2014	48	100	---

③ The transition matrix $P = \begin{bmatrix} P_{00} & P_{01} \\ P_{10} & P_{11} \end{bmatrix}$

$$= \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \text{ So we need } P_0^5$$

$$P^2 = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

$$P^4 = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} = \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix}$$

$$P^5 = \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 0.66656 & 0.33344 \\ 0.66688 & 0.33312 \end{bmatrix}$$

The probability that the customer will enter the shop from 9am to 2pm is 0.66656

(4)

Given $\lambda = 2$ per minute.

Probability of elapsed time between 10th & 11th mail

i) more than 1 minute

$$P(T > 1) = e^{-\lambda t} = e^{-2 \times 1} = 0.13534$$

ii) less than 2 minutes

$$P(T < 2) = 1 - e^{-\lambda t} = 1 - e^{-2 \times 2} = 1 - 0.01832$$

iii) between 1 - 2 minutes.

$$\begin{aligned} P(1 < T < 2) &= e^{-\lambda t_1} - e^{-\lambda t_2} \\ &= e^{-2 \times 1} - e^{-2 \times 2} \\ &= 0.13534 - 0.01832 \\ &= 0.11702 \end{aligned}$$

Name: Sidul Islam Sohag

Id: 20-42668-1

Serial: 16

Answer to the Q; No: 1

Calculate the trend value semi-average method.

Year	2008	2009	2010	2011	2012	2013
Income(incomes)	43	51	64	76	81	96

Ans:

Year	Income	3 Year Semi Total	3 Year Semi average	Trend value
2008	43	158	52.6	$52.6 - 10.56 = 42.04$
2009	51			$42.04 + 10.56 = 52.6$
2010	64			$52.6 + 10.56 = 63.16$
2011	76			$63.16 + 10.56 = 73.72$
2012	81	253	84.3	$73.72 + 10.56 = 84.28$
2013	96			$84.28 + 10.56 = 94.84$

Difference between the central years = 2012-2009
= 3

Q: b) i)

I-2008P-02161

Difference between the semi-averages

$$\text{Semi-Average} = \frac{\text{Sum of values}}{\text{Number of values}} = \frac{84.33 + 52.67}{3} = 68.50$$

$$\text{Difference} = 68.50 - 52.67 = 15.83$$

$$\text{Increase in trend value for one year} = \frac{15.83}{3} = 5.28$$

Increase in trend value for one year

Year	1st SF	2nd SF	3rd SF	4th SF	5th SF	6th SF	7th SF	8th SF	9th SF	10th SF	11th SF	12th SF
2004	40	42	39	25	27	51	28	26	31	30	48	40
2005												
2006												
2007												
2008												
2009												
2010												
2011												
2012												
2013												
2014												

Answer to the Q: No: 2

3-Year Moving Average,

Year	1oun	3 Year Semitotal	3-Year Semi average
2004	40	— — — 80	— — —
2005	42	121	40.33
2006	39	106	35.33
2007	25	91	30.33
2008	27	103	34.333
2009	51	106	35.333
2010	28	105	25
2011	26	85	18.333
2012	31	87	29
2013	30	109	36.333
2014	48	— — —	— — —

Answer to the Q : No:3

The transition probability matrix

$$P = \begin{bmatrix} P_{00} & P_{01} \\ P_{10} & P_{11} \end{bmatrix} = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

We need P_{00}^5 in P^5

$$P^2 = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

$$P^4 = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

$$= \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix}$$

$$P^5 = \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 0.66656 & 0.33344 \\ 0.66688 & 0.33312 \end{bmatrix}$$

The required probability is = 0.66656

Ans

4 i) more than 1 minute,

$$P(T > 1) = e^{-\lambda t} = e^{-2 \times 1} = 0.1353$$

ii) less than 2 minutes,

$$\begin{aligned} P(T < 2) &= 1 - e^{-\lambda t} \\ &= 1 - e^{-2 \times 2} \\ &= 1 - e^{-4} \\ &= 0.9816 \end{aligned}$$

iii) between 1 to 2 minutes,

$$\begin{aligned} P(1 < T < 2) &= e^{-\lambda t_1} - e^{-\lambda t_2} \\ &= e^{-2 \times 1} - e^{-2 \times 2} \end{aligned}$$

$$\begin{aligned} &= e^{-2} - e^{-4} \\ &= 0.1353 - 0.0183 \end{aligned}$$

$$= 0.117$$

Name: Jamnatul Ferdose Tamisha
ID: 20-42669-1
Serial: 17

Final Assignment - 1

Ans to the Question No - 1

Calculate the trend value using semi averages method.

Years	2008	2009	2010	2011	2012	2013
Income	43	51	64	76	81	96

Ans:

Year	Income	5 Years semi total	7 years moving	Trend values
2008	43			$52.67 - 10.55 =$ 42.118
2009	51	158	52.67	$42.11 + 10.55 =$ 52.67
2010	64			$52.67 + 10.55 =$ 63.22
2011	76			$63.22 + 10.55 =$ 73.77
2012	81	253	84.33	$73.77 + 10.55 = 84.32$
2013	96			$84.32 + 10.35 =$ 94.87

L-0 22 01 08 01

Fl. Glance

2

Now,

→ 01/01/2009 with 01/01/2012

Difference between the central Years = 2012 -
2009

= 3

$$\begin{array}{|c|c|c|c|c|c|c|} \hline & 8105 & 8105 & 1105 & 0105 & 0005 & 0005 \\ \hline u & 18 & 3F & u & 12 & 8K & 8K \\ \hline 30 & & & 12 & & & \\ \hline \end{array}$$

∴ semi-averages = $84.83 - 52.67$
 $= 31.66$

Increase in trend value for one Year

$$= \frac{31.66}{3}$$

$$= 10.55$$

3

Ans to the Q. No - 2

Year	Loan	3-year semi Total	3-year semi average
2004	40	- - -	- - -
2005	42	121	40.83
2006	39	106	35.33
2007	25	91	30.33
2008	27	103	34.33
2009	51	106	35.33
2010	28	105	35
2011	26	85	28.33
2012	31	87	29
2013	30	109	36.33
2014	48	- - -	- - -

Ans to the Q. NO - 03

The transition probability matrix

$$P = \begin{bmatrix} P_{00} & P_{01} \\ P_{10} & P_{11} \end{bmatrix} = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

We need P_{00}^5 in P^5

$$P^2 = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \cdot \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

$$P^4 = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \cdot \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

$$= \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix}$$

6

$$P^5 = \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 0.66656 & 0.33344 \\ 0.66688 & 0.33312 \end{bmatrix}$$

The required probability is 0.66656

[Ans.]

6

Ans to the Q.No.-4

i) more than 1 minute,

$$P(T > 1) = e^{-\lambda t} = e^{-2 \times 1} = 0.1353$$

ii) less than 2 minute,

$$\begin{aligned} P(T < 2) &= 1 - e^{-\lambda t} \\ &= 1 - e^{-2 \times 2} \\ &= 1 - e^{-4} \\ &= 0.9816 \end{aligned}$$

iii) between 1 to 2 minute

$$\begin{aligned} P(1 < T < 2) &= e^{-\lambda t_1} - e^{-\lambda t_2} \\ &= e^{-2 \times 1} - e^{-2 \times 2} \\ &= e^{-2} - e^{-4} \\ &= 0.1353 - 0.0183 \\ &= 0.117 \end{aligned}$$