author

Analysis of a Geriatric Ward

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based upon the study
J. Meridith, "A Markovian
Analysis of a Geriatric Ward",
Management Science, June 1972

At the California Napa State Hospital,
a resocialization program (GRP: Geriatric
Resocialization Program) was instituted in 1964
in order to deinstitutionalize geriatric (elderly)
paitents so that they could be placed in boarding
homes or their equivalent outside the hospital.

An analysis was performed to determine the
costs and benefits of the program.

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Markov Chain Model

Current or former patients are classified
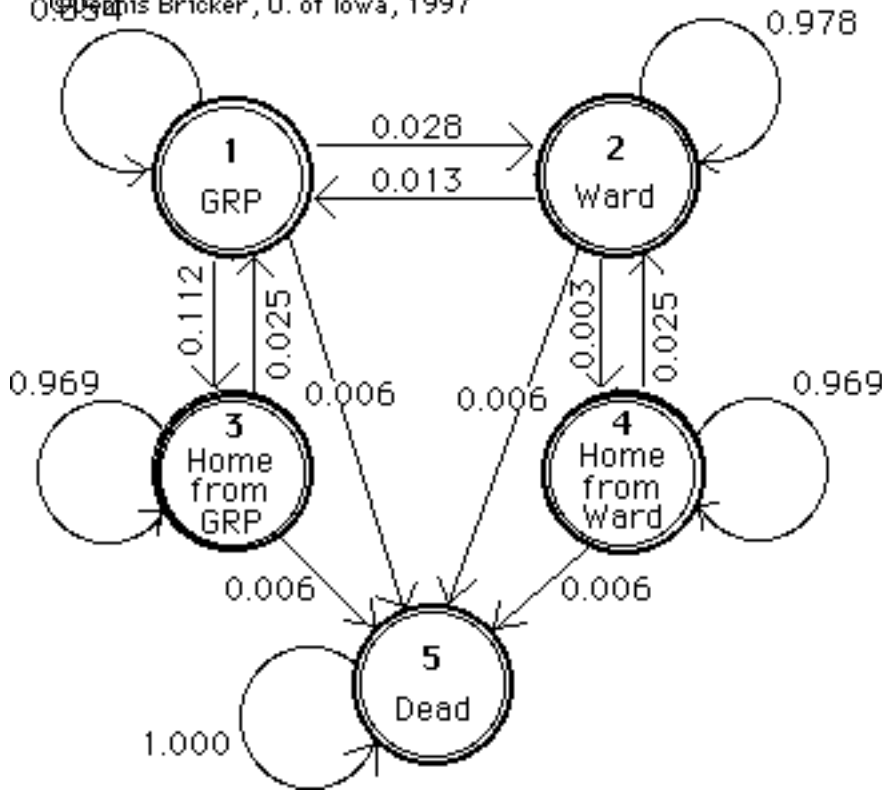in one of the following states:

1. in the resocialization program (GRP)
2. in one of the hospital wards
3. in a boarding home, but placed from GRP
4. in a boarding home, but placed directly
   from a hospital ward
5. dead

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One-month Transition Probabilities & Costs

from \ to	GRP	Ward	Home (from GRP)	Home (from Ward)	Dead	Cost per Month($)
GRP	0.854	0.028	0.112	0.000	0.006	682
Ward	0.013	0.978	0.000	0.003	0.006	655
Home (from GRP)	0.025	0.000	0.969	0.000	0.006	226
Home (from Ward)	0.000	0.025	0.000	0.969	0.006	226
Dead	0.000	0.000	0.000	0.000	1.000	0

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0.854

0.978

1
GRP

0.028

2
Ward

0.013

0.112
0.025

0.003
0.025

0.969

3
Home
from
GRP

0.006

0.006

4
Home
from
Ward

0.969

0.006

0.006

5
Dead

1.000

Markov Chain Model

Note that state 5 "Dead" is absorbing

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Transition Probability Matrix

	to				
from	1	2	3	4	5
1	0.854	0.028	0.112	0	0.006
2	0.013	0.978	0	0.003	0.006
3	0.025	0	0.969	0	0.006
4	0	0.025	0	0.969	0.006
5	0	0	0	0	1

states

i	name
1	GRP
2	Hospital Ward
3	Home (from GRP)
4	Home (from Ward)
5	Dead

```
Analysis of Markov Chain
with Absorbing States
```

```
A = Absorption Probabilities
```

states

i	name
1	GRP
2	Hospital Ward
3	Home (from GRP)
4	Home (from Ward)
5	Dead

```
  \ to
   \      5
f   _____
r
o  1|  1
m  2|  1
   3|  1
   4|  1
```

"Nothing is certain but death & taxes!"

```
E = Expected No. Visits to Transient States
```

```
  \ to
   \        1           2            3           4
f   _____
r
o  1| 26.963165  38.556882   97.415308   3.7313112
m  2| 17.90141   76.669561   64.676061   7.419635
   3| 21.744488  31.09426   110.8188     3.0091219
   4| 14.436621  61.830291   52.158114  38.241641
```

```
COST ← 682 655 226 226

E +.× COST
66502.773 78720.951 60921.591 70774.961
```

Life expectancy of a patient in GRP is sum of first row, namely 166.66 months!

states

i	name
1	GRP
2	Hospital Ward
3	Home (from GRP)
4	Home (from Ward)
5	Dead

i	current state of patient	cost/patient (lifetime)
1	GRP	66502.77
2	Hospital Ward	78720.95
3	Home (from GRP)	60921.59
4	Home (from Ward)	70774.96

Total cost to the state of a GRP patient during his/her remaining lifetime will be $66,502

For a patient currently in a hospital ward, this cost will be approximately $12,000 more.

Suppose that GRP were not in existence. What would be the cost per person?
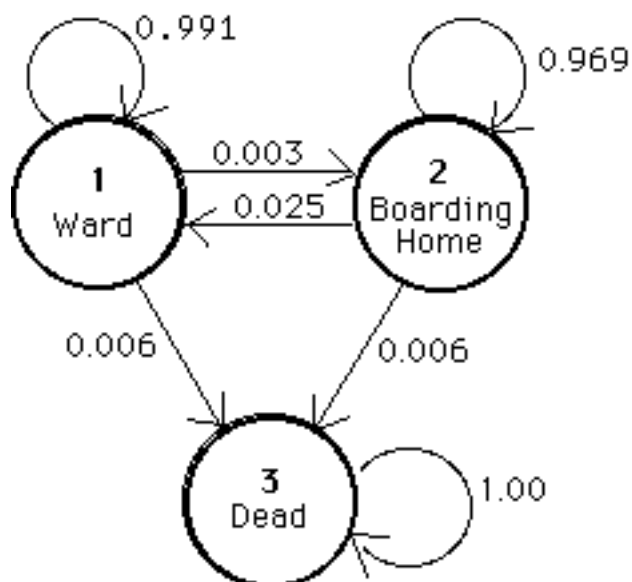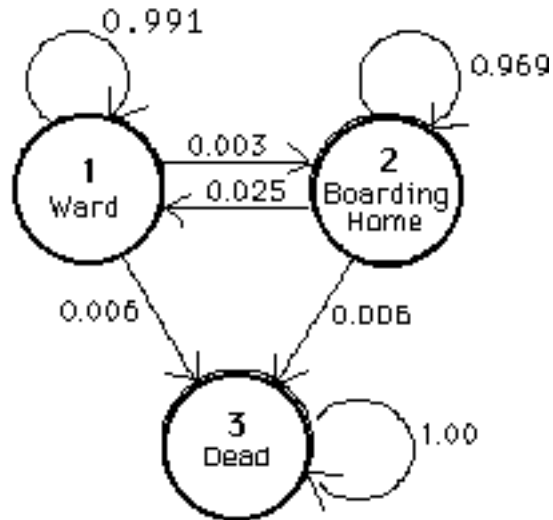
There are now only three states

Transition Probability Matrix

states

i	name
1	Hospital Ward
2	Boarding Home
3	Dead

```
    to
f       1      2      3
r
o  1 | 0.991  0.003  0.006
m  2 | 0.025  0.969  0.006
   3 | 0      0      1
```

A = Absorption Probabilities

states

i	name
1	Hospital Ward
2	Boarding Home
3	Dead

```
     to
f        3
r
o   1 |  1
m   2 |  1
```

```
E = Expected No. Visits to Transient States
```

```
          \ to
         f  \        1           2
         r   \
         o   1| 151.96078  14.705882
         m   2| 122.54902  44.117647
```

COST ← 655 226

E +.× COST

102857.84 90240.196

*Note that the life expectancy
of a patient in the ward is
151.96 + 14.71 = 166.67 months*

states

i	name
1	Hospital Ward
2	Boarding Home
3	Dead

i	current state of patient	cost/patient (lifetime)
1	Hospital Ward	102857.84
2	Boarding Home	90240.19

*If GRP were not instituted, the expected cost to the
state for a patient in a hospital ward, for his/her remaining
lifetime, would be $102,857.*

*This is compared to the cost of a patient in the GRP program,
namely $66,502!*