Part B
7.(a)

P(Trav=true) = 0.05

P(OC=true) = 0.6

Trav

OC

FP

IP

CRP
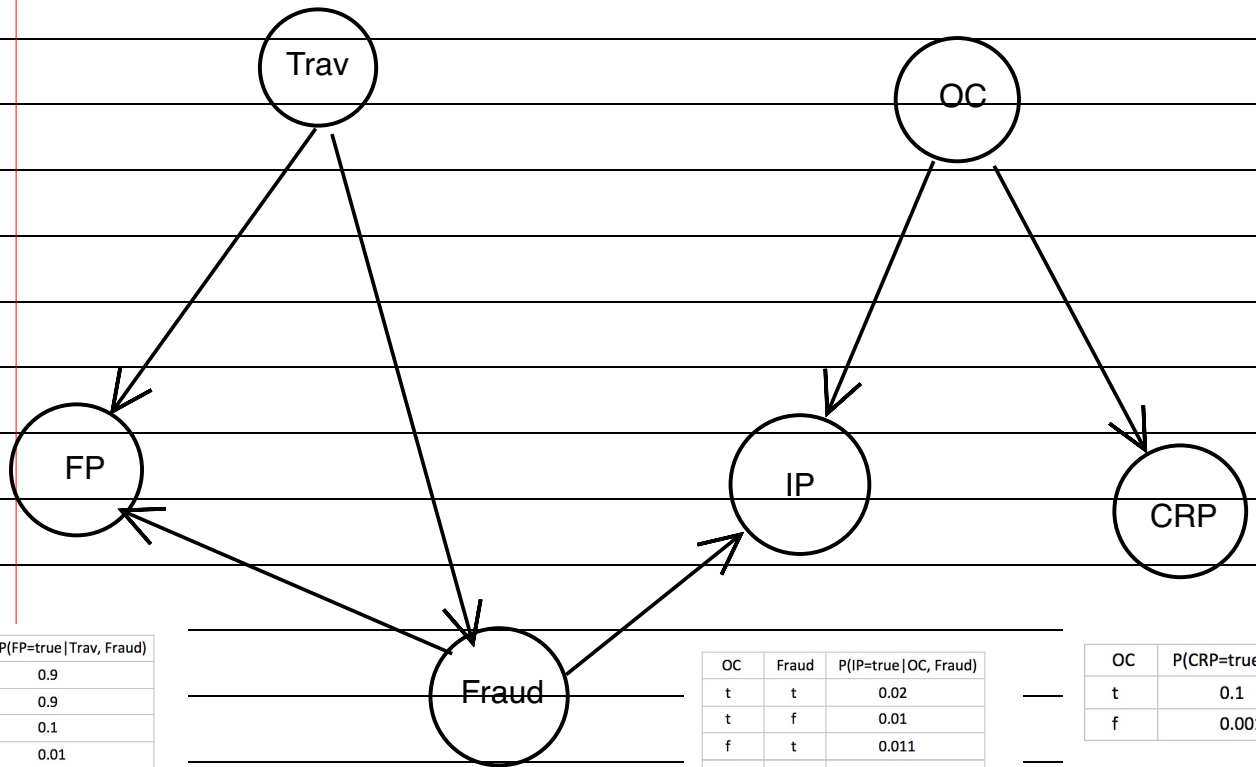
Fraud

| Trav | Fraud | P(FP=true\|Trav, Fraud) |
|------|-------|-------------------------|
| t | t | 0.9 |
| t | f | 0.9 |
| f | t | 0.1 |
| f | f | 0.01 |

| OC | Fraud | P(IP=true\|OC, Fraud) |
|----|-------|-----------------------|
| t | t | 0.02 |
| t | f | 0.01 |
| f | t | 0.011 |
| f | f | 0.001 |

| OC | P(CRP=true\|OC) |
|----|-----------------|
| t | 0.1 |
| f | 0.001 |

| Trav | P(Fraud=true\|Trav) |
|------|---------------------|
| t | 0.01 |
| f | 0.004 |

**2b**

```
Q2b(1)************************
Trav         P
t            0.05
f            0.95

Fraud        Trav        P
t            t           0.01
t            f           0.004
f            t           0.99
f            f           0.996

Eliminating variable Trav:
Fraud        Trav        P
t            t           0.0005
f            t           0.0495
t            f           0.0038
f            f           0.9461999999999999

Fraud        P
t            0.0043
f            0.9956999999999999

Pr(Fraud):
Fraud        P
t            0.004300000000000001
f            0.9957
```
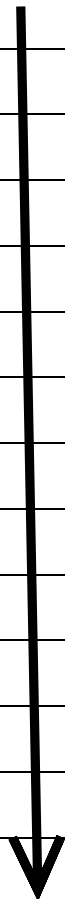
```
Q2b(2)************************
Trav        P
t           0.05
f           0.95

Fraud       Trav        P
t           t           0.01
t           f           0.004
f           t           0.99
f           f           0.996

OC          P
t           0.6
f           0.4

Restrict FP = t
Trav        Fraud       P
t           t           0.9
t           f           0.9
f           t           0.1
f           f           0.01

Restrict IP = f
OC          Fraud       P
t           t           0.98
t           f           0.99
f           t           0.989
f           f           0.999

Restrict CRP = t
OC          P
t           0.1
f           0.001

Eliminating variable Trav:
Fraud       Trav        P
t           t           0.0005
f           t           0.0495
t           f           0.0038
f           f           0.9461999999999999

Trav        Fraud       P
t           t           0.00045000000000000004
t           f           0.044550000000000006
f           t           0.00038
f           f           0.009462

Fraud       P
t           0.00083
f           0.054012000000000004

Eliminating variable OC:
Fraud       OC          P
t           t           0.588
f           t           0.594
t           f           0.3956
f           f           0.3996

Fraud       OC          P
t           t           0.0588
f           t           0.0594
t           f           0.0003956
f           f           0.0003996

Fraud       P
t           0.0591956
f           0.0597996

Fraud       P
t           4.9132348e-05
f           0.0032298959952000005

Pr(Fraud|fp, ~ip, crp) =
Fraud       P
t           0.014983813147541077
f           0.985016186852459
```

2c

```
Q2c*************************
Fraud        Trav         P
t            t            0.01
t            f            0.004
f            t            0.99
f            f            0.996

OC        P
t         0.6
f         0.4

Restrict Trav = t
P
0.05

Restrict Trav = t
Fraud         P
t             0.01
f             0.99

Restrict FP = t
Trav         Fraud         P
t            t             0.9
t            f             0.9
f            t             0.1
f            f             0.01

Restrict Trav = t
Fraud         P
t             0.9
f             0.9

Restrict IP = f
OC        Fraud         P
t         t             0.98
t         f             0.99
f         t             0.989
f         f             0.999

Restrict CRP = t
OC        P
t         0.1
f         0.001

Eliminating variable OC:
Fraud         OC         P
t             t          0.588
f             t          0.594
t             f          0.3956
f             f          0.3996

Fraud         OC         P
t             t          0.0588
f             t          0.0594
t             f          0.0003956
f             f          0.0003996

Fraud         P
t             0.0591956
f             0.0597996

Fraud         P
t             0.0005
f             0.0495

Fraud         P
t             0.000450000000000000004
f             0.0445500000000000006

Fraud         P
t             2.6638020000000003e-05
f             0.0026640721800000005

Pr(Fraud|fp, ~ip, crp, trav):
Fraud         P
t             0.0098999995919292979
f             0.990100004080707
```

2d

```
Q2d(1)************************
Trav          P
t             0.05
f             0.95

FP            Trav          Fraud          P
t             t             t              0.9
t             t             f              0.9
t             f             t              0.1
t             f             f              0.01
f             t             t              0.1
f             t             f              0.1
f             f             t              0.9
f             f             f              0.99

OC            P
t             0.6
f             0.4

CRP           OC            P
t             t             0.1
t             f             0.001
f             t             0.9
f             f             0.999

Restrict IP = t
OC            Fraud          P
t             t              0.02
t             f              0.01
f             t              0.011
f             f              0.001

Eliminating variable Trav:
Fraud          Trav           P
t              t              0.0005
f              t              0.0495
t              f              0.0038
f              f              0.9461999999999999

FP            Trav          Fraud          P
t             t             t              0.00045000000000000004
f             t             t              5e-05
t             t             f              0.044550000000000006
f             t             f              0.00495
t             f             t              0.00038
f             f             t              0.00342
t             f             f              0.009462
f             f             f              0.936738

FP            Fraud          P
t             t              0.00083
f             t              0.00347
t             f              0.054012000000000004
f             f              0.941688

Eliminating variable FP:
Fraud          P
t              0.0043
f              0.9957

Eliminating variable OC:
Fraud          OC             P
t              t              0.012
f              t              0.006
t              f              0.0044
f              f              0.0004

Fraud          CRP            OC             P
t              t              t              0.0012000000000000001
t              f              t              0.0108
f              t              t              0.0006000000000000001
f              f              t              0.0054
t              t              f              4.4e-06
t              f              f              0.0043956
f              t              f              4.0000000000000003e-07
f              f              f              0.0003996
```

```
Fraud          CRP            P
t              t              0.0012044000000000002
t              f              0.0151956
f              t              0.0006004000000000001
f              f              0.0057996

Eliminating variable CRP:
Fraud          P
t              0.0164
f              0.0064

Fraud          P
t              7.052000000000001e-05
f              0.0063724800000000001

Pr(Fraud|ip):
Fraud          P
t              0.010945211857830203
f              0.9890547881421697
```

```
Q2d(2)************************
Trav        P
t           0.05
f           0.95

FP          Trav        Fraud       P
t           t           t           0.9
t           t           f           0.9
t           f           t           0.1
t           f           f           0.01
f           t           t           0.1
f           t           f           0.1
f           f           t           0.9
f           f           f           0.99

OC          P
t           0.6
f           0.4

CRP         OC          P
t           t           0.1
t           f           0.001
f           t           0.9
f           f           0.999

Restrict IP = t
OC          Fraud       P
t           t           0.02
t           f           0.01
f           t           0.011
f           f           0.001

Restrict CRP = t
OC          P
t           0.1
f           0.001

Fraud       Trav        P
t           t           0.0005
f           t           0.0495
t           f           0.0038
f           f           0.9461999999999999

FP          Trav        Fraud       P
t           t           t           0.00045000000000000004
f           t           t           5e-05
t           t           f           0.044550000000000006
f           t           f           0.00495
t           f           t           0.00038
f           f           t           0.00342
t           f           f           0.009462
f           f           f           0.936738

FP          Fraud       P
t           t           0.00083
f           t           0.00347
t           f           0.054012000000000004
f           f           0.941688

Eliminating variable FP:
Fraud       P
t           0.0043
f           0.9957

Eliminating variable OC:
Fraud       OC          P
t           t           0.012
f           t           0.006
t           f           0.0044
f           f           0.0004

Fraud       OC          P
t           t           0.0012000000000000001
f           t           0.0006000000000000001
t           f           4.4e-06
f           f           4.0000000000000003e-07
```

```
Fraud       P
t           0.0012044000000000002
f           0.0006004000000000001

Fraud       P
t           5.178920000000001e-06
f           0.00059781828

Pr(Fraud|ip, crp):
Fraud       P
t           0.00858863026229641
f           0.9914113697377036
```

The probability can be decreased by CRP = true.
If I just make an internet purchase, then the probability of a fraudulent transaction Pr(fraud|ip) is 0.0109. However, if I can make a computer related purchase in the past week, then the probability can be decreased to Pr(fraud|ip, crp) = 0.0086.