1. Proof:
2. Pr(Oil) = 0.5, Pr(Gas) = 0.2, Pr(Neither) = 0.3, Pr(Positive|Oil) = 0.9, Pr(Positive|Gas) = 0.3, Pr(Positive|Neither) = 0.1



1. The DAG looks like:

We can create a new RV Coin for the coin that is drawn.

CPT Coin:

|  |  |
| --- | --- |
| Coin | Pr(Coin) |
| A | 1/3 |
| B | 1/3 |
| C | 1/3 |

|  |  |  |
| --- | --- | --- |
| Coin |  |  |
| A | T | 0.2 |
| A | F | 0.8 |
| B | T | 0.4 |
| B | F | 0.6 |
| C | T | 0.8 |
| C | F | 0.2 |

CPT Bell:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  | Bell |  |
| T | T | T | T | 1 |
| T | T | T | F | 0 |
| T | T | F | T | 0 |
| T | T | F | F | 0 |
| T | F | T | T | 0 |
| T | F | T | F | 0 |
| T | F | F | T | 0 |
| T | F | F | F | 0 |
| F | T | T | T | 0 |
| F | T | T | F | 0 |
| F | T | F | T | 0 |
| F | T | F | F | 0 |
| F | F | T | T | 0 |
| F | F | T | F | 0 |
| F | F | F | T | 1 |
| F | F | F | F | 0 |

1. False, the path A,D,B,E is open because D is convergent and B is divergent.
2. True, B is closed because B is divergent and is part of the evidence. H cannot be used in a path either since it is convergent.
3. True, CDE is given as evidence, and no path exists.

)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | A | B |  | Pr(A, B) |
|  | T | T | T | 0.3 |
|  | T | F | F | 0.2 |
|  | F | T | T | 0.1 |
|  | F | F | T | 0.4 |

1. = 0.375

|  |  |  |
| --- | --- | --- |
| A | B |  |
| T | T | = 0.3 / 0.8 = 0.375 |
| T | F | 0 |
| F | T | = 0.1 / 0.8 = 0.125 |
| F | F | = 0.4 / 0.8 = 0.5 |