AI Assignment 3

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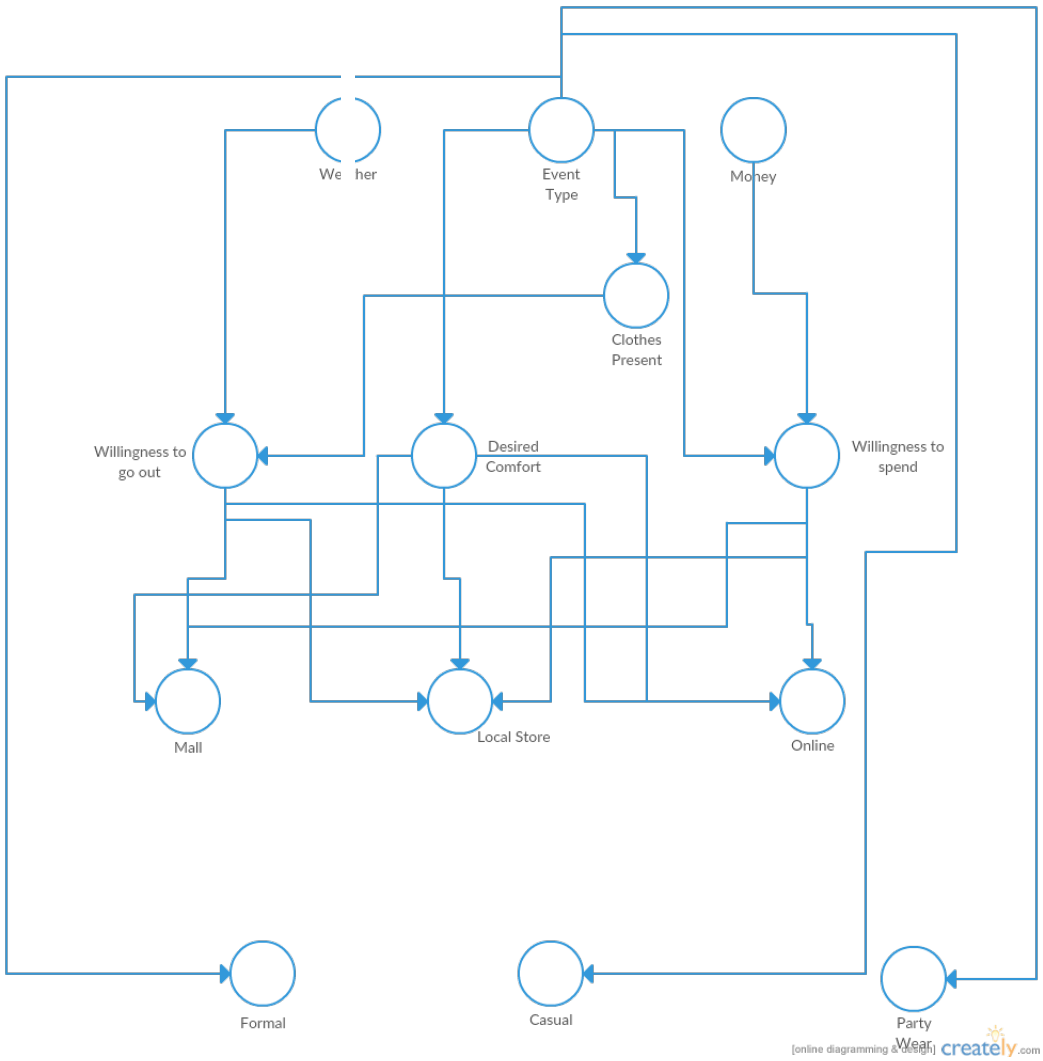

1 Key Table

Symbol	Key	Value
W	Weather	Rainy, Sunny, Other
E	Event Type	Normal, Wedding, Party
WO	Willingness to go out	High, Low
WS	Willingness to spend	High, Low
M	Mall	Yes, No
LS	Local Store	Yes, No
OL	Online	Yes, No
MY	Money	High, Low, Average
C	Clothes present	Yes, No
DC	Desired Comfort	High, Average
F	Formal	Yes, No
CS	Casual	Yes, No
PW	Party Wear	Yes, No

2 Conditional Probability Tables

1. Weather

W	Rainy	Sunny	Other
P(W)	0.2	0.5	0.3

2. Event type

E	Wedding	Party	Normal
P(E)	0.2	0.3	0.5

3. Money

M	High	Low	Average
P(M)	0.2	0.3	0.5

4. Clothes present

E	C.Yes	C.No
Wedding	0.3	0.7
Party	0.4	0.6
Normal	0.5	0.5

5. Willingness to go out

W	C	WO.High	WO.Low
Rainy	Yes	0.3	0.7
Rainy	No	0.5	0.5
Sunny	Yes	0.5	0.5
Sunny	No	0.7	0.3
Other	Yes	0.4	0.6
Other	No	0.6	0.4

6. Willingness to spend

E	MY	WS.High	WS.Low
Wedding	High	0.8	0.2
Wedding	Low	0.4	0.6
Wedding	Average	0.5	0.5
Party	High	0.6	0.4
Party	Low	0.2	0.8
Normal	High	0.5	0.5
Normal	Low	0.1	0.9
Normal	Average	0.3	0.7

7. Desired Comfort

E	DC.High	DC.Low
Wedding	0.2	0.8
Party	0.5	0.5
Normal	0.7	0.3

8. Mall

WO	DC	WS	M.Yes	WO.No
High	High	High	0.6	0.4
High	High	Low	0.7	0.3
High	Average	High	0.8	0.2
High	Average	Low	0.7	0.3
Low	High	High	0.3	0.7
Low	High	Low	0.4	0.6
Low	Average	High	0.3	0.7
Low	Average	Low	0.2	0.8

9. Local Store

WO	DC	WS	LS.Yes	LS.No
High	High	High	0.4	0.6
High	High	Low	0.6	0.4
High	Average	High	0.7	0.3
High	Average	Low	0.8	0.2
Low	High	High	0.2	0.8
Low	High	Low	0.3	0.7
Low	Average	High	0.4	0.6
Low	Average	Low	0.5	0.5

10. Online

WO	DC	WS	LS.Yes	LS.No
High	High	High	0.1	0.9
High	High	Low	0.2	0.8
High	Average	High	0.2	0.8
High	Average	Low	0.3	0.4
Low	High	High	0.5	0.5
Low	High	Low	0.6	0.4
Low	Average	High	0.6	0.4
Low	Average	Low	0.8	0.2

11. Online

M	LS	O	LS.Yes	LS.No
High	High	High	0.1	0.9
High	High	Low	0.2	0.8
High	Average	High	0.2	0.8
High	Average	Low	0.3	0.4
Low	High	High	0.5	0.5
Low	High	Low	0.6	0.4
Low	Average	High	0.6	0.4
Low	Average	Low	0.8	0.2

12. Formal

E	F.Yes	F.No
Wedding	0.8	0.2
Party	0.6	0.4
Normal	0.2	0.8

13. Casual

E	CS.Yes	CS.No
Wedding	0.2	0.8
Party	0.6	0.4
Normal	0.9	0.1

14. Party Wear

E	PW.Yes	PW.No
Wedding	0.7	0.3
Party	0.8	0.2
Normal	0.4	0.6

3 Justifications

1. **Weather:**
   Assumed probabilities of each happening.

2. **Event type:**
   Probabilities of each event happening in the Indian society, amongst our age demographic.

3. **Money:**
   Stands for the probabilities of having lots of money (High), moderate amount of money (Average), and low amount of money (Low) - and this limits how much/what/from where the user buys stuff.

4. **Clothes present:**
   Refers to the probability that the person has a specific form of clothing - wedding dress, casual dress or party wear, corresponding to the respective event.

5. **Willingness to go out:**
   Refers to the willingness of the person to get out of his house - whether its high or low. This obviously will decide the probabilities of whether the user would want to go out (to mall or local shop) to buy clothes or not.

6. **Willingness to spend:**
   Refers to the person's willingness to spend money - whether he's ready to spend a large amount of money,or a small amount of money only. This will decide where he prefers shopping - if he has a lot of money, he wouldn't mind spending at the mall, and hence the probability of the same would be high, and so on. Also, we've assumed the person wouldn't want to spend huge amounts online (to be safe, and to check fitting of expensive clothing before purchase).

7. **Desired Comfort:**
   Refers to how much the person desires comfort - high (a lot of comfort or just decent amount of comfort), and hence the probabilities of where he would shop. We have assumed that clothes at the mall would be of more comfort than online and local. We haven't considered low amount of comfort, and probability of that would generally be 0 anyways.

8. **Mall, Online, Local Store:**
   Refers to whether the person would want to go to the mall, online and local store to buy clothes for a specific set of conditions or not - and hence two states: yes or no. Where a person buys his clothes from doesn't decide anything else!

9. **Casual, Formal, Party Wear:**
   Refers to the whether the person wants to buy any of these form of clothing, hence 2 states: yes and no. Obviously, it would depend on what occasion exists - wedding, party or just a casual outing.

4 Query

Query:
P(Mall = Yes | $DC = High, E = Wedding$)

is of the form P(X | $p(X), p(p(X))$).
By conditioning we have,

P(Mall = Yes | $DC = High, E = Wedding$) = $P(Mall = Yes \mid DC = High, WS = Low) * P(WS = Low \mid E = Wedding) + P(Mall = Yes \mid DC = High, WS = High) * P(WS = High \mid E = Wedding)$

The following probability are given:

P(E = Wedding) = 0.2
P(E = Party) = 0.3
P(E = Normal) = 0.5
P(MY = High) = 0.2
P(MY = Low) = 0.3
P(MY = Avg) = 0.5
P(W = Sunny) = 0.5
P(W = Rainy) = 0.2
P(W = Other) = 0.3

Following are calculated:

P(C = Yes) = 0.3*0.2 + 0.4*0.3 + 0.5*0.5 = 0.06 + 0.12 + 0.25 = 0.43

P(C = No) = 0.7*0.2 + 0.6*0.3 + 0.5*0.5 = 0.14 + 0.18 + 0.25 = 0.57

P(DC = High) = (0.2*0.2) + (0.5*0.3) + (0.7*0.5) = 0.54
P(DC = Low) = (0.8*0.2) + (0.5*0.3) + (0.3*0.5) = 1-0.54 = 0.46

P(WO = High) = (0.3*0.43*0.2) + (0.5*0.57*0.2) + (0.5*0.43*0.5) + (0.7*0.57*0.5) + (0.4*0.43*0.3) + (0.6*0.57*0.3) = 0.544

P(WO = Low) = 1 - 0.544 = 0.456

Calculating right side probabilities:
P(WS = Low | $E = Wedding$) = $(0.2 * 0.2) + (0.6 * 0.3) + (0.5 * 0.5) = 0.47$

P(WS = High | $E = Wedding$) = $(0.8 * 0.2) + (0.4 * 0.3) + (0.5 * 0.5) = 0.53$

Calculating left side probabilities:
P(Mall = Yes | $DC = High, WS = Low$) = $(0.7 * 0.544) + (0.4 * 0.456) =$ 0.5632
P(Mall = Yes | $DC = High, WS = High$) = $(0.6 * 0.544) + (0.3 * 0.456) =$ 0.4632

Calculating final probabilities:

P(Mall = Yes | $DC = High, E = Wedding$) = $P(Mall = Yes \mid DC = High, WS = Low) * P(WS = Low \mid E = Wedding) + P(Mall = Yes \mid DC = High, WS = High) * P(WS = High \mid E = Wedding)$

= (0.5632 * 0.47) + (0.4632 *0.53) = 0.5102

Thus, P(Mall = Yes | $DC = High, E = Wedding$) = 0.5102