AI: Assignment 3
BAYESIAN NETWORKS

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Topic: 5) **Felicity Elections** (1099%15+1)

Problem statement: Felicity elections are about to come soon. You suspect there are going to be a lot of candidates approaching you for your vote. There are a number of factors you have to consider while selecting your coordinators e.g popularity, ability, support, etc. Model a Bayesian network predicting whom you will select based on the above factors. Give conditional probabilities and justify.

Bayesian Network:
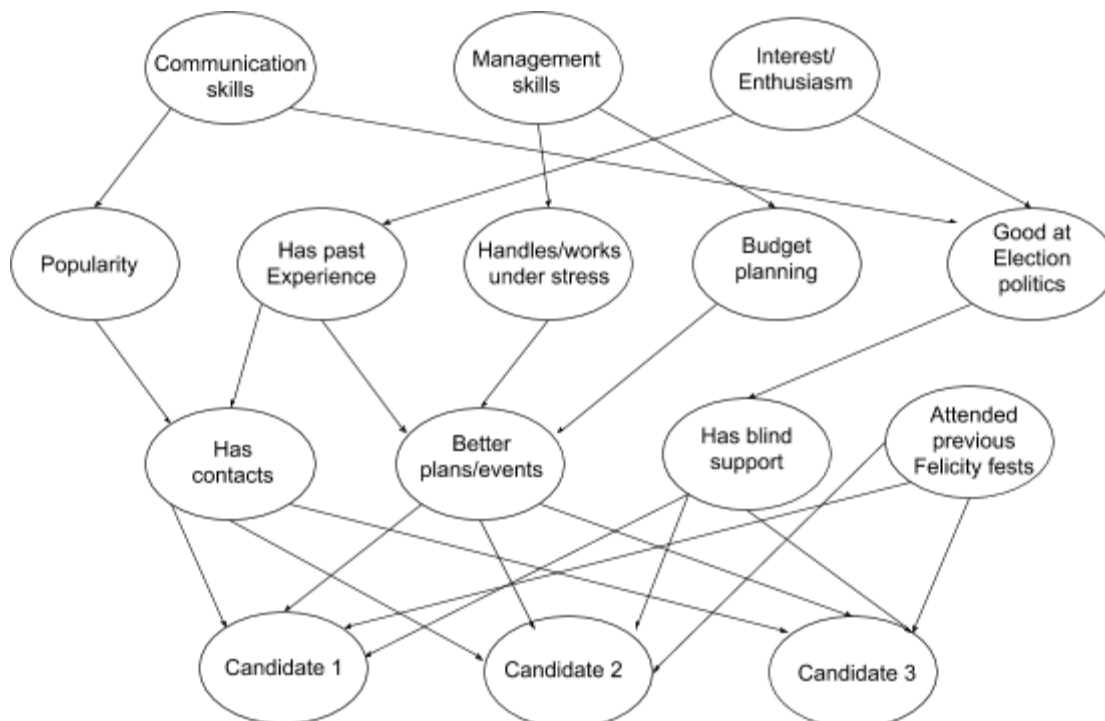
Key:

FF	Attended previous Felicity fests	All, Some, None
CS	Communication skills	Good, Average, Bad
MS	Management skills	Good, Average, Bad
IE	Interest/Enthusiasm	High, Low
P	Popularity	High, Average, Low
PE	Has past experience	Yes, No
ST	Handles stress well	Yes, No
BP	Budget planning	Good, Average, Bad
EP	Election Politics	Yes, No
C	Number of contacts	High, Average, Low
EV	Events/Plans	Good, Average, Bad
SP	Support	High, Average, Low
C1	Candidate 1	Yes, No
C2	Candidate 2	Yes, No
C3	Candidate 3	Yes, No

Assumption: Only one FC needs to be elected - hence 3 candidates are enough.

Conditional Probability Tables:

Attended previous Felicity fests:

FF	All	Some	None
P(FF)	0.35	0.45	0.2

Communication skills:

CS	Good	Average	Bad
P(CS)	0.3	0.5	0.2

Management skills:

MS	Good	Average	Bad
P(MS)	0.3	0.5	0.2

Interest/Enthusiasm:

IE	High	Low
P(MS)	0.7	0.3

Popularity:

CS	P.High	P.Average	P.Low
Good	0.7	0.2	0.1
Average	0.3	0.5	0.2
Bad	0.1	0.2	0.7

Has past experience:

IE	PE.Yes	PE.No
High	0.8	0.2
Low	0.2	0.8

Handles stress well:

MS	ST.Yes	ST.No
Good	0.7	0.3
Average	0.5	0.5
Bad	0.3	0.7

Budget planning:

MS	BP.Good	BP.Average	BP.Bad
Good	0.7	0.2	0.1
Average	0.3	0.5	0.2
Bad	0.1	0.2	0.7

Election Politics:

CS	IE	EP.Yes	EP.No
Good	High	0.6	0.4
Good	Low	0.4	0.6
Average	High	0.5	0.5

Average	Low	0.3	0.7
Bad	High	0.2	0.8
Bad	Low	0.1	0.9

Number of Contacts:

P	PE	C.High	C.Average	C.Low
High	Yes	0.85	0.15	0.05
Average	Yes	0.25	0.4	0.35
Low	Yes	0.15	0.45	0.4
High	No	0.65	0.3	0.05
Average	No	0.2	0.3	0.5
Low	No	0.1	0.2	0.7

Events/Plans:

PE	ST	BP	EV.Good	EV.Average	EV.Bad
Yes	Yes	Good	0.65	0.3	0.05
Yes	Yes	Average	0.5	0.3	0.2
Yes	Yes	Bad	0.1	0.05	0.85
Yes	No	Good	0.5	0.28	0.22
Yes	No	Average	0.4	0.25	0.18
Yes	No	Bad	0.05	0.05	0.9
No	Yes	Good	0.55	0.35	0.1
No	Yes	Average	0.38	0.3	0.32

No	Yes	Bad	0.23	0.29	0.48
No	No	Good	0.36	0.25	0.39
No	No	Average	0.05	0.35	0.6
No	No	Bad	0.01	0.25	0.74

Support:

EP	SP.High	SP.Average	SP.Low
Yes	0.7	0.2	0.1
No	0.3	0.3	0.4

Candidate 1:

FF	C	EV	SP	P(C1.Yes)
All	High	Good	High	0.95
All	High	Good	Average	0.93
All	High	Good	Low	0.9
All	High	Average	High	0.80
All	High	Average	Average	0.77
All	High	Average	Low	0.75
All	High	Low	High	0.70
All	High	Low	Average	0.67
All	High	Low	Low	0.64
All	Low	Good	High	0.74

All	Low	Good	Average	0.69
All	Low	Good	Low	0.65
All	Low	Average	High	0.60
All	Low	Average	Average	0.57
All	Low	Average	Low	0.52
All	Low	Low	High	0.32
All	Low	Low	Average	0.27
All	Low	Low	Low	0.24

Candidate 2:

FF	C	EV	SP	P(C2.Yes)
Some	High	Good	High	0.84
Some	High	Good	Average	0.82
Some	High	Good	Low	0.79
Some	High	Average	High	0.69
Some	High	Average	Average	0.66
Some	High	Average	Low	0.64
Some	High	Low	High	0.59
Some	High	Low	Average	0.57
Some	High	Low	Low	0.53
Some	Low	Good	High	0.63
Some	Low	Good	Average	0.58

Some	Low	Good	Low	0.55
Some	Low	Average	High	0.50
Some	Low	Average	Average	0.47
Some	Low	Average	Low	0.41
Some	Low	Low	High	0.22
Some	Low	Low	Average	0.16
Some	Low	Low	Low	0.13

Candidate 3:

FF	C	EV	SP	P(C3.Yes)
None	High	Good	High	0.72
None	High	Good	Average	0.70
None	High	Good	Low	0.67
None	High	Average	High	0.57
None	High	Average	Average	0.54
None	High	Average	Low	0.52
None	High	Low	High	0.47
None	High	Low	Average	0.45
None	High	Low	Low	0.41
None	Low	Good	High	0.51
None	Low	Good	Average	0.46
None	Low	Good	Low	0.43

None	Low	Average	High	0.38
None	Low	Average	Average	0.35
None	Low	Average	Low	0.29
None	Low	Low	High	0.10
None	Low	Low	Average	0.04
None	Low	Low	Low	0.01

Justifications:

1. Past Experience does not have as good an effect on having a good number of contacts as popularity does which basically implies having good communication skills has more effect on making contacts than a person's interest in the field.

2. Support doesn't have much influence on selecting a candidate - because it is highly dependent on election politics and not more important qualities like stress handling, budget planning etc. Hence, even if support is less but event planning and budget are good the candidate is preferred as it can be seen that the drop for good to bad events is more than high to low support.

3. The level of events/plans plays a major role in selecting a candidate to vote for, followed by a number of contacts which would contribute to better promotions and sponsorship.

4. Whether the candidate attended the previous events or not - has a significant influence on the choice of candidate.

5. Communication skills affect election politics more than the interest of the candidate to contribute to/become FC - which is true as politics is more in favour of one who can mould people's ideas in his/her favour and use tricks to convince them to vote.

Sample Query:

P(Number of contacts=high | Popularity=High, Communication skills=Average)

=> [Σ_{PE} P(C=High| P=High, PE)*P(PE)] --(a)
=> (P(C=High| P=High, PE=Yes)*P(PE=Yes) + P(C=High| P=High, PE=No)*P(PE=No))   --(b)

Now,

Σ_{IE} P(PE=Yes| IE)*P(IE) --(c)
=> P(PE=Yes| IE=High)*P(IE=High) + P(PE=Yes| IE=Low)*P(IE=Low) --(d)

And

Σ_{IE} P(PE=No| IE)*P(IE) --(e)
=> P(PE=No| IE=High)*P(IE=High) + P(PE=No| IE=Low)*P(IE=Low) --(f)

Now,

P(IE=High)= 0.7   --(i)
P(IE=Low)= 0.3   --(ii)

Substituting (i) and (ii) in (d) and (f) we get,

P(PE=Yes| IE=High)*0.7 + P(PE=Yes| IE=Low)*0.3 --(d2)
= 0.8*0.7 + 0.2*0.3 = 0.56 + 0.6 = 0.62
=> P(PE=Yes) = 0.62 --(iii)

And

P(PE=No| IE=High)*0.7 + P(PE=No| IE=Low)*0.3 --(f2)
= 0.2*0.7 + 0.8*0.3 = 0.14 + 0.24 = 0.38
=> P(PE=No) = 0.38 --(iv)

Substituting (iii) and (iv) in (b)

P(C=High| P=High, PE=Yes)*P(PE=Yes) + P(C=High| P=High, PE=No)*P(PE=No)

=> (P(C=High| P=High, PE=Yes)*0.62 + P(C=High| P=High, PE=No)*0.38)*0.3*0.5

=> (0.85 * 0.62 + 0.65 * 0.38)

=> <mark>P(Number of contacts=high | Popularity=High, Communication skills=Average) = 0.774</mark>