7. Using a Belief Network Tool (20 points) *Mahin*

Fig. 2: Astronomer looking at the sky

Assume we have 3 astronomers in different parts of the world who make measurements M1, M2 and M3 of the number[2] of stars N in some region of the sky. Normally[3], there is a probability of 0.05 that the astronomer counts a single star twice (overcounts by one star; you can assume that the four astronomers never undercount; moreover, if there is no star visible (N=0) the astronomer never overcounts). Moreover, there is a 10% probability ($P(F_i=1)=0.1$ for i=1,2,3) that a telescope is out of focus (represented using random variables F1, F2, and F3), in which the astronomer undercounts by 2 or more stars (e.g. if N is 3 and the astronomer's telescope is out of focus, the astronomer will count 1 or 0 stars; if N, on the other hand, is 2 an astronomer with an out of focus telescope will count 0 stars). You can assume if information is missing that each case has the same probability. Design a belief network, and compute the probability of the other variables assuming the following pieces of evidence are given (feel free to use *Netica (*http://www.norsys.com/download.html) or any another belief network tool to compute your answer[4]!):

1. M1=4 M2=3 M3=1
2. M1=3 M2=3 M3=0
3. N=3 M2=1 M3=0
4. N=4 M1=6
5. N=4 F1=0 F2=0 F3=1
6. N=6
7. No evidence

Submit the complete Belief Network you created—including all its probability tables—, and the findings you obtained for the seven cases listed above!

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[2] You can assume that N is limited to 7—but the astronomer do not know that: M1, M2 and M3 are therefore limited to values 0 through 8.

[3] Assuming the astronomer's telescope is not out of focus

[4] Including the answer 'inconsistent' in the case that the evidence is inconsistent, e.g, the evidence N=1 M1=3 is inconsistent—as it is 'impossible', because astronomer1 never overcounts by more than 1 star!