Exercise #2: *The riddle of Thursday night*

El Farol is a bar on Canyon Road, Santa Fe, where every Thursday evening a music band plays.

You assume that in Santa Fe there are ***100 people***, who would like to go to El Farol to listen to music; but none of them wants to go there, if the pub is too crowded.

You must understand how many people will go to the pub the next Thursdays.

The persons know only the number of people that attended on each of the last "M" Thursdays.

M is the *number of weeks for which the attendance number is known*, this information is same for all person. (E.g., if M = 3, you might have this information: three weeks ago: 35, two weeks ago: 76, one week ago: 20).

There isn't prior communication among people.

At this point, each individual uses regardless of some forecasting method, to estimate how many people will go to the pub the next week.

Each person has some number **N** of *strategies*, each of which uses the information from past Thursdays to predict attendance for this Thursday.

Everyone has a possibly different set of strategies.

For example, if N = 3, the strategies might be:

– Strategy 1: Predict attendance will be the same as last week

– Strategy 2: Predict attendance will be 100 – last week

– Strategy 3: Predict attendance will be: 0.2 * last week + 0.1 * two weeks ago

You suppose that each of these people decide, independently, to go to the pub.

The people take this decision, in according with their ***best strategy***: *the one that did the best prediction about the attendance on previous Thursday. Then they use their "current best" strategy to predict attendance for the current Thursday.*

If the expected number of people, which will go to the pub on Thursday, is *greater* than **60** therefore you will *stay at home*, otherwise you will come out.

After the prediction and, consequently, the decision, the people go to the pub and the next day the new number of appearances is published in the newspaper.

Everyone then updates the accuracy of forecasting methods at disposal; then whole works repeats the following week.

Details:

- **N**: the number of strategies for each person, is equal to **5**;
- **M**: the number of weeks for which the attendance number is known, is **10**;
- **A**: the attendances of last Thursday nights (t-j) j=1…10; (For the values look the attached Excel file)
- Each strategy **S** has the following form:

$$S(t) = w_1*A(t-1) + w_2*A([t-2) + \ldots + w_i*A(t-i)]$$

  - w_i : the weights of the strategies. They are different for each strategy. Their sum, for each strategy, is equal to one. (For the values look the attached Excel file)

$$\sum w_i = 1 \ , \ x \ \forall \ S(t) \ (i=1 \ldots 10 \text{ and } w_i \in [0,1])$$

  - **A**: Attendances of last Thursday nights *(t-j) j=1…10*

- Each *time step* of the model corresponds to a new Thursday, on which you must understand how many will go to the pub.
- The "**best current strategy**" is the strategy with the *lowest* **error**. The error is the difference between the prediction P(S) of each strategy (S) and the actual attendance.

$$Error(S) = P(S) - A$$

Question:

How many people will go to the pub "El Farol" the next Thursdays?