

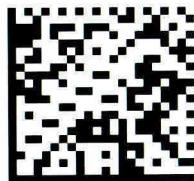
NOM BOUKHELOUA

Prénom Rémi

Promo 2020

Date

16,5



20150257: BOUKHELOUA Rémi

M1:

ST2BDIT-DE (19/04/2019)

Amphi jaune

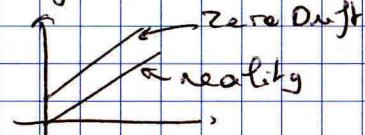
## MATIÈRE IOT (1/2)

1. Sensitivity is the unit change of a sensor

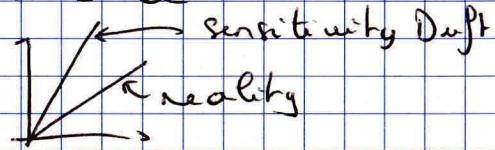
Resolution is the ~~unit~~ smallest change possible of a sensor.

2. Repeatability is the dispersion observed on the measure of the same input ~~of sensor~~ in same conditions.

3. A sensor measurement could suffer from zero drift which is a difference of value when  $x = 0$



It could suffer from sensitivity Drift which is a difference in slope curve



It could suffer from Hysteresis phenomena where each value depends on past one.

Finally, it could suffer from Deadspace which is ~~a~~ missing values.

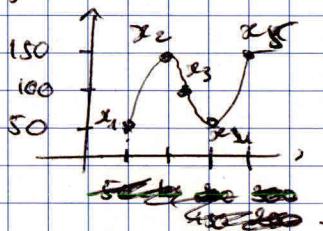
Everything is due to random ~~noise~~ like human measure or due to recurrent errors that can be fixed by calibration, design sensor, filter against noise and so on.

5. Time series patterns are Seasonality and Trends.

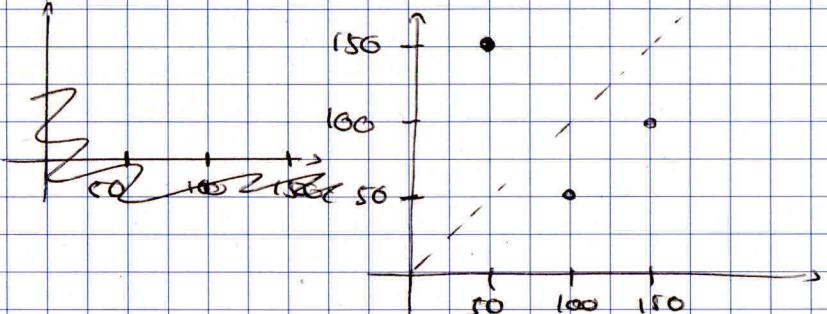
Seasonality means data are ~~following~~ correlated at a certain frequency, by month for example.

Trends means data are correlated ~~recent~~ on recent data. For example they follow  $x_{t+1} \propto x_t$ .

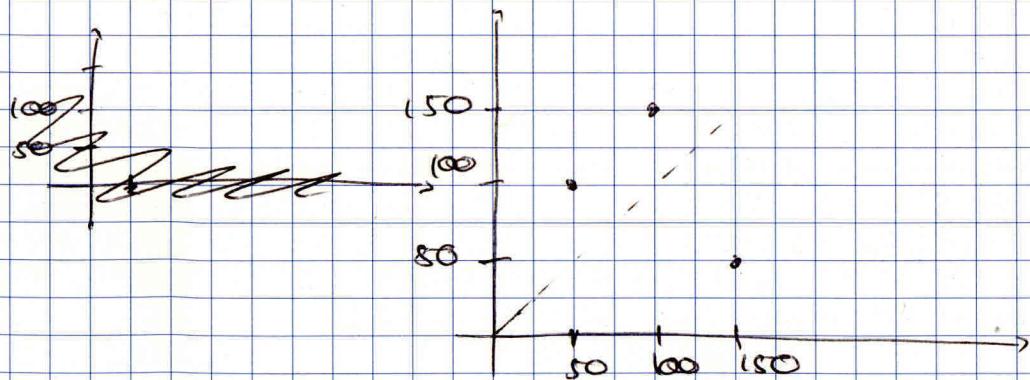
6. ~~A seasonal plot is changing~~ We ~~can~~ plot seasonality in a lag plot where we compare measure  $x_{i+1}$  with  $x_i$ , then  $x_{i+2}$  with  $x_i$  if we have.



Lag 1:  $(50; 150), (150; 50), (50, 50)$   
 $(50; 150), (150; 100), (100; 50), (50; 150)$



Lag d.  $(50, 100), (150, 50), (100, 150)$



At  $2^{\text{nd}}$  lag we should find a pattern matching.

7. On the ~~for~~ ACF representation, we can clearly distinguish a seasonality. because we can see that every 6 lag, we have "same" ~~sack~~ spike.

8. On this ACF representation, we can see trends over the lag as they seems to evolve according to a function.

9. As very simple time series prediction model we have the actual one where  $y_{t+1} = y_t$ , the naive seasonality where  ~~$y_{t+1} = y_t + \text{seasonality}$~~  we assume a seasonality and output result of last measurement for this seasonality.

10. We could decompose a time series in three parts, Seasonality, Trends and a Remainder as following.

$$S \times T \times R \quad \text{or} \quad S + T + R$$

Using ~~smooth~~ exponential smoothing might be the simplest way of removing seasonality and trends so extracting them.

11. Count Min sketch is a way of counting frequency of words with limited memory space. ~~For example~~ It follows ~~to~~ this algorithm:

w is received.

if w is in the list

| C. w++.

else

| w replace the ~~lower~~ index of lower ~~max~~ count.

C. w++.

13. Time series database such as Graphite are different from "classical" ones as they focuses on time series they store a simple time series measure (Time, Value, Sensor identifier such as ID). We don't have the choice of structuring of ~~the~~ the ~~other~~ data. Moreover they provide some retention possibilities like in Graphite where you can ~~choose~~ decide of frequency of data storage over a period. 7s:1d, 1m:2d will be each 7s for 11days and 1m for 2 days. Moreover, as sensor can suffer from dead spaces, they provide an auto-completion mode where they add record even when they don't receive any.

14. Many fields can benefit from IoT such as houses where smart ones could ~~manage tasks~~ light down depending of sunlight or perform ~~it~~ predefined tasks such as open the door based on your face instead of keys. Smart cities where traffic light could change and adapt themselves on traffic to prevent cars from being stuck. Smart grid could also benefit from it as ~~they are~~ with sensors we would know where to input electricity and how much instead of overloading the network. Moreover, with the new producers of electricity ~~such~~ that do it on their home, there's a new source of electricity that ~~are~~ companies have to quantify. If they don't an too big input would break down the network. That's one of the main feature of new counter-Lindy.

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## MATIÈRE IOT(2/2)

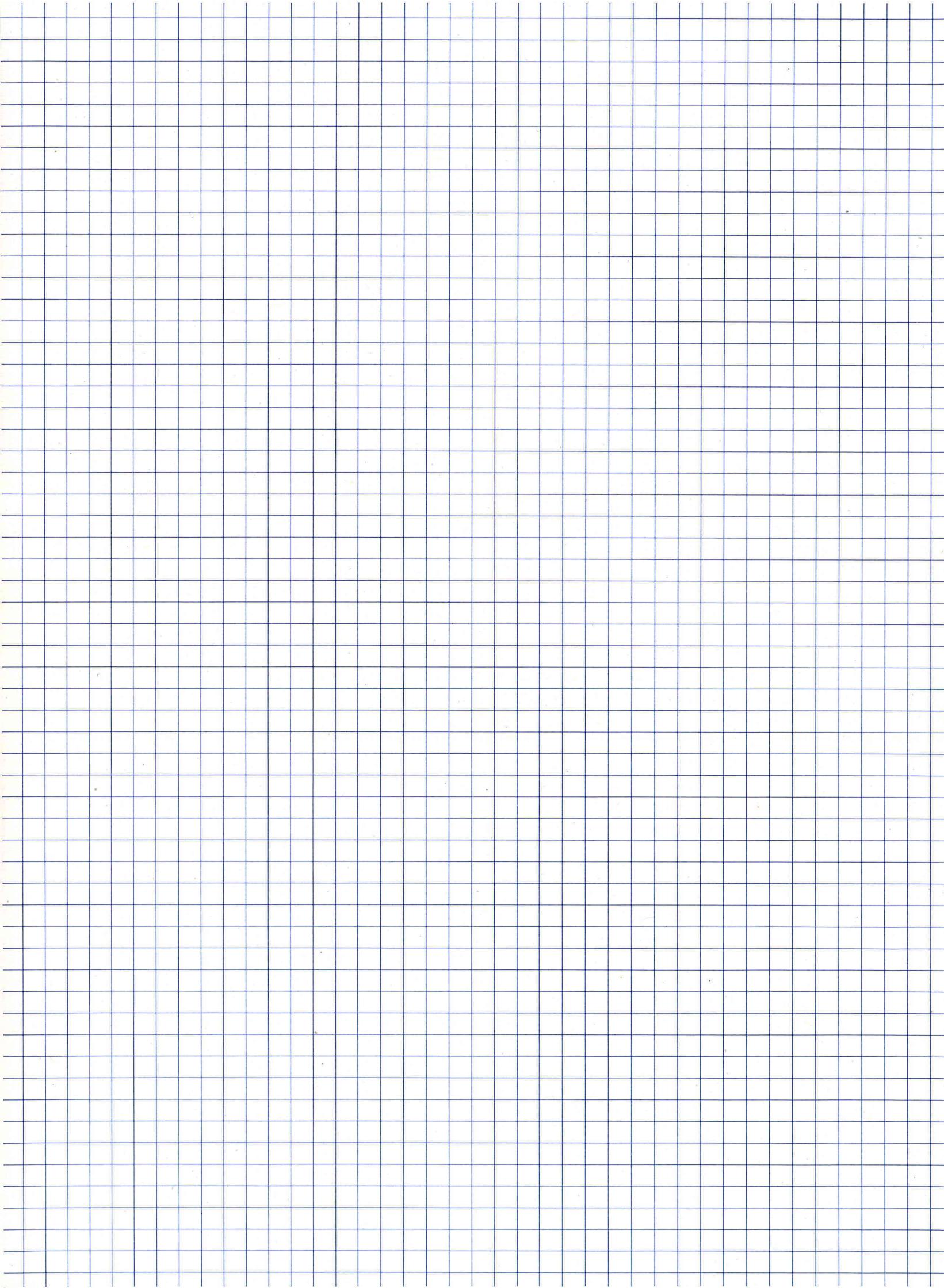
15. IOT can be described following three perspective:

- Internet p. where internet has the role of connecting real device with virtual ones.
- Thing p. where IOT devices have the role of connecting mostly to virtual world
- Semantic perspective where we focus on how devices communicates, network and Big Data.

11. Exponential smoothing, Holt and HoltWinters algorithms allow us to ~~to extract data~~ ~~remove~~ extract seasonality and trends from the data. After using one of it, we have pure data cleaned from patterns and hysteria effect. We can also extracted seasonality and trends produced.





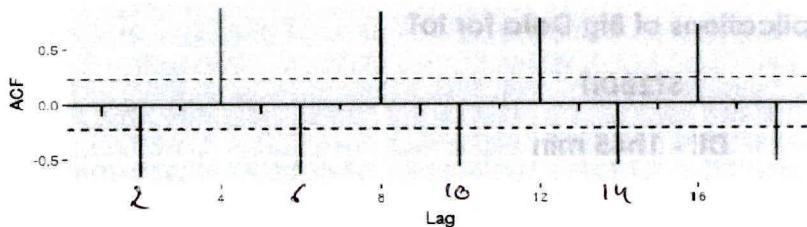




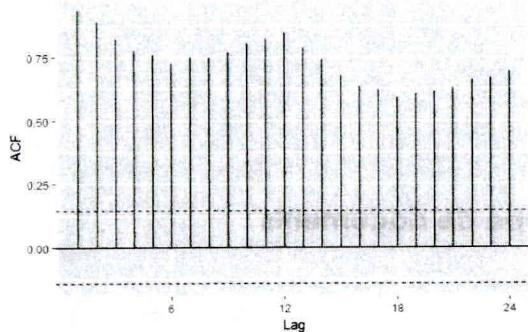


Ne rien inscrire dans ce cadre

- + 1. What is a sensitivity and resolution characteristics of a sensor?
- ✓ 2. What is repeatability of measurements?
- + 3. Comment on what can go wrong with sensor measurements.
- + 4. What is quantization effect? Sketch it.
- + 5. Provide examples of typical time series patterns.
- + 6. What is a seasonal plot? Sketch one.
- + 7. How to interpret the following ACF

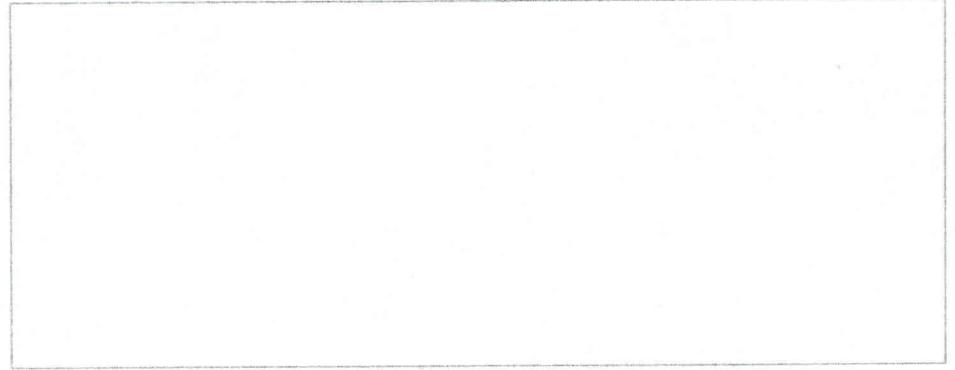


- + 8. How to interpret the following ACF



- + 9. Show several examples of very simple time series prediction models
- + 10. What is time series decomposition? What is a simplest way to calculate seasonality and trend?
- ✓ 11. What is exponential smoothing, Holt, Holt-Winters algorithms
- + 12. How does the Count-Min sketch algorithm work for counting elements?
- ✓ 13. How time series databases are different from the "classical" databases?
- + 14. Smart houses, smart cities, and smart grids are areas where the Internet of Things can provide improvements. Present and discuss at least one benefit in each of these examples.
- ✓ 15. The Internet of Things has different definitions. One of the reasons is related to IoT's perspectives. Cite and describe these perspectives.

Semantic  
Internet  
of Things



Ne rien inscrire dans ce cadre

Prénom ..... Rémi.....

Nom ..... BENKHÉLOUF.....

Promotion ..... S2020.....

Groupe .....

**Promotion M1**

**Applications of Big Data for IoT**

**ST2BDIT**

**DE - 1h45 min**

**Date Horaire**

Sujet proposé par :

Calculatrice autorisée :  **OUI**       **NON**

Documents autorisés :  **OUI**       **NON**      **Type de documents :**

Ordinateur portable autorisé :  **OUI**       **NON**

Internet :  **OUI**       **NON**

Traducteur électronique, dictionnaire :  **OUI**       **NON**

**Consigne :**

Merci de restituer uniquement : « **choisir un élément de la liste** »

**Rappel :**

- Tous les appareils électroniques (téléphones portables, ordinateurs, tablettes, montres connectées ...) doivent être éteints et rangés.
- Il est interdit de communiquer.
- Toute fraude ou tentative de fraude fera l'objet d'un rapport de la part du surveillant et sera sanctionnée par la note zéro, assortie d'une convocation devant le conseil de discipline. Aucune contestation ne sera possible. Tous les documents et supports utilisés frauduleusement devront être remis au surveillant.
- Aucune sortie de la salle d'examen ne sera autorisée avant la moitié de la durée de l'épreuve.