Baccalauréat 2021 - Académie de Lille

Epreuve de Discipline Non Linguistique
Mathématiques/Anglais

Problématique 1: mathématiques et jeux **Sujet 5**
Thèmes: game design, dés, probabilités

L'usage de la calculatrice est autorisé.
Temps de préparation: 20 minutes.
Ce sujet, ainsi que les brouillons, seront à rendre à l'examinateur.

Leagueofgamemakers.com is a website to help game designers build their own game. Since probability theory is essential to game design, game designer **James Ernest** tries to explain the basics of probability theory as it applies to game design. Here is an example :

To win a game of "Roll Six Times" you have to roll a 10-sided die six times. Each turn, you must roll higher than the current turn number. For example, on turn 3, you must roll a 4 or higher. If you ever roll below the turn number, you lose. How hard is it to win a game of "Roll Six Times"?

On turn 1, you have to roll a 2 or higher. This has odds 9/10, or 90%. On turn 2, the odds reduce to 80%, and so on.

http://www.leagueofgamemakers.com/probability-for-game-designers/

1- Explain the game in your own words.
2- Explain the sentence "On turn 1, you have to roll a 2 or higher. This has odds of 9/10, or 90%".
3- What is the probability of winning the game (i.e. succeeding all of the 6 turns)?
4- What if we used a 20-sided die instead of a 10-sided die?
5- What if we used two 6-sided dice?

Web search
Own work – Public Domain

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Mathématiques/Anglais

Problématique 1: mathématiques et jeux **Sujet 14**
Thèmes: jeu de plateau, statistiques, Game of Thrones

L'usage de la calculatrice est autorisé.
Temps de préparation: 20 minutes.
Ce sujet, ainsi que les brouillons, seront à rendre à l'examinateur.

Here is an excerpt from the rules of *A game of thrones, the board game,* by Edge Entertainment:

OVERVIEW

A Game of Thrones: The Board Game is a game for three to six players, based on George R. R. Martin's bestselling *A Song of Ice and Fire* novels. In *A Game of Thrones: The Board Game*, players each control one of six Great Houses seeking dominance over the lands of Westeros. By mustering armies, conquering territory and forming alliances, each House strives to control the most Castles and Strongholds so it may ultimately claim the Iron Throne.

OBJECT OF THE GAME

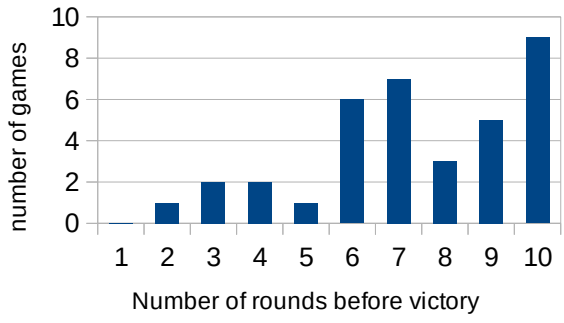
At the end of the 10th game round, the House that controls the most areas containing either a Castle or Stronghold is declared the winner. If, at any time during the game, a player controls seven such areas, that player immediately wins the game.

These are statistics about the game, collected by players on *boardgamegeek.com*:

Winning family	Stark	Baratheon	Tyrell	Martell	Greyjoy	Lannister
Nb of games won	5	10	8	1	7	5

1°) Consider the second set of data (number of rounds before victory). Work out the mean, the median and the mode. Which ones do you find representative of the data?

2°) Consider the first set of data (winning families). Is it possible to work out a mean? a median? A mode?



3°) On the box of the game, the playing time is said to be between 120 and 240 minutes. What are the possible lengths for one round knowing this information and the data given above?

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Problématique 2 :
Mathématiques, monde de l'économie, développement durable **Sujet 5**
Thèmes : bénéfice et fonction

L'usage de la calculatrice est autorisé.
Temps de préparation: 20 minutes.
Ce sujet sera à rendre à l'examinateur ainsi que les brouillons.

Earl's Biking Company manufactures and sells bikes.
Each bike costs £40 to make, and the company's fixed costs are £5000.

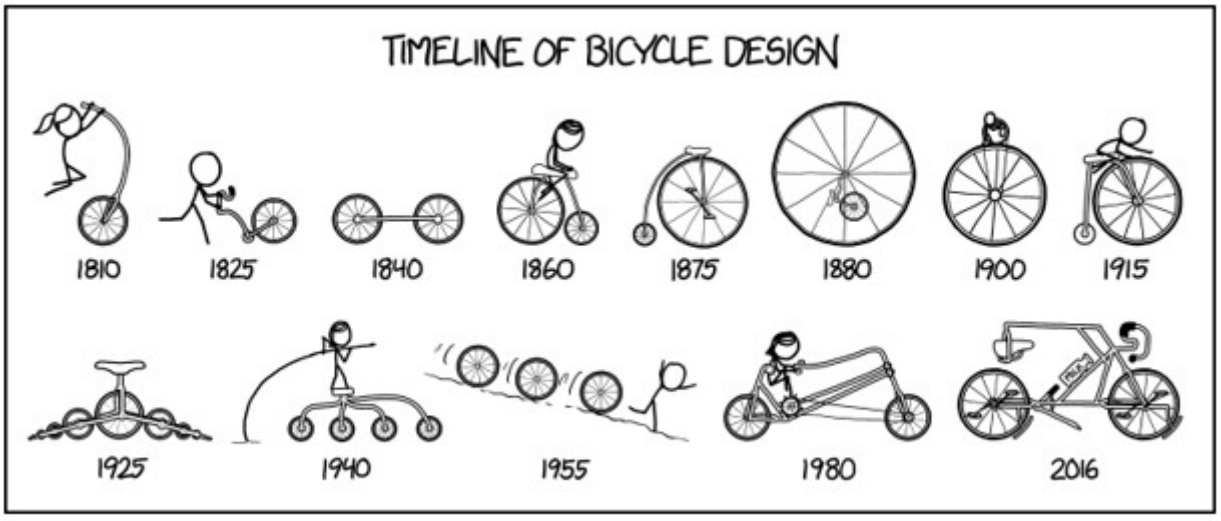
In addition, Earl knows that the price of each bike comes from the price function $f(x) = 300 - 2x$ where x denotes the number of bikes produced per year.

1- Show that the revenue in terms of x is given by the formula $R(x) = 300x - 2x^2$.

2- Show that the cost in terms of x is given by the formula $C(x) = 5000 + 40x$.

3- Show that the company's profit function, in terms of x, is $P(x) = -5000 + 260x - 2x^2$.

4- Find the output level that maximizes the company's profit, and the maximum profit.



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Epreuve de Discipline Non Linguistique
Mathématiques/Anglais

Problématique 2: Mathématiques, monde de l'économie, développement durable Sujet 9
Thèmes : recettes et fonction

L'usage de la calculatrice est autorisé.
Temps de préparation: 20 minutes.
Ce sujet sera à rendre à l'examinateur ainsi que les brouillons.

Currently, a local newspaper company sells print subscriptions for £9.30 a month and has 2400 subscribers.

Based on a conducted survey, they expect to lose 20 subscribers for each £0.10 increase from the current monthly subscription price.

1- Complete the following table:

Price for subscription (£)	Number of subscribers	Revenue (£)
9.3	2400	22320
9.4	2380	
10		

Let x be the number of £0.10 increases.

2- Write down the expected number of subscribers sold in terms of x.

3- Prove that the revenue is given by the formula: $R(x)=22\,320+54\,x-2\,x^2$

4- What should the newspaper company charge for a monthly subscription in order to maximize the revenue from the print newspaper subscriptions?

Newspaper advertisement for Sylvan Valley News subscription, 1910
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Mathématiques/Anglais

Problématique 3 : Mathématiques, écologie, santé, sciences **Sujet 11**
Thèmes : Algorithme, déforestation .

L'usage de la calculatrice est autorisé. Temps de préparation: 20 minutes.
Cette planche sera à rendre à l'examinateur.

In 2020, a country had approximately 100,000 hectares of forests. Every decade, it is estimated that the number of hectares of forests will decrease by 20%. In order to slow down this deforestation, a non-governmental organisation (NGO) has decided to plant 3,000 hectares of trees every decade.

(vocabulary : a decade is ten years)

1- How many hectares of forests will there be in 2030 ? 2040?

2- Here is a function written in Python (*n is the number of decades)* :

```
def forest(n) :
    h = 100000
    for k in range(n) :
        h = h * 0.8 + 3000
    return h
```

a) Explain the algorithm.
b) Run the algorithm step by step for $n = 3$

3- Complete the following algorithm to find the year when the number of hectares of forests will go below 30,000 for the first time. Explain.

```
def year():
    n = 0
    h = 100000
    while h ...
        n = n + ...
        h =  ...
    return 2020 + ...
```

"Illegal deforestation underway!" by Daniel Beilinson under CC BY-SA 2.0