



Full Name : _____ Student ID: _____

Grade Table (for Lecturer use only)

Question	Points	Score
1	50	
2	50	
Total:	100	

Instructions for Midterm Exam

Welcome to the midterm exam of EEE483 - Introduction to Energy Analytics (I2EA) and good luck!

Please read the following rules and confirm by signing that you have read and understood the rules before you receive your exam:

- The midterm exam should be conducted between 15:00 and 17:45. Exam duration is 165 minutes. Students must finalise the exam by delivering it before 17:45. Students are not allowed to leave the exam in the first 30 minutes.
- Student ID cards should visibly be on the edge of desks till the end of the exam. Students without the student ID cards or Turkish identity cards should not be participated into the exam.
- This is a closed-book exam which means that students are not allowed to take notes, books, or any other reference material into the exam. Throughout the exam, students should not possess mobile phones and electronic devices that are capable of storing, receiving or transmitting information or electronic signals, such as computerised watches.
- Students are not allowed to take a glance at the exam questions until told to do so. Students should not communicate with any other student under any circumstances during the exam period. A student, who cheats, tries to cheat during the exam, or is identified to be cheating after investigating exam documents, is given 0 (zero) for that exam and a disciplinary investigation is opened against the student.
- An incorrect answer to a question is awarded no marks with no consideration of any partial credit. Therefore, no partial credit will be given.

In recognition of and in the spirit of the above rules which constitute Adana Alparslan Türkeş Science and Technology University Honour Code, I certify that I will neither give nor receive unpermitted aid on this examination.

Signature: _____

1. (a) (5 points) What does the first law of thermodynamics state? Describe the relationship between energy and power by emphasising the formula. Match the following units with either energy or power: Btu, hp, J, toe/year, W, and Wh.

- (b) (10 points) In Figure 1, the evolution of Turkish electricity markets and actors is presented. Fill in the white blanks with the appropriate terms including *Generation*, *Transmission*, *Distribution*, *Wholesale*, or a combination of them.

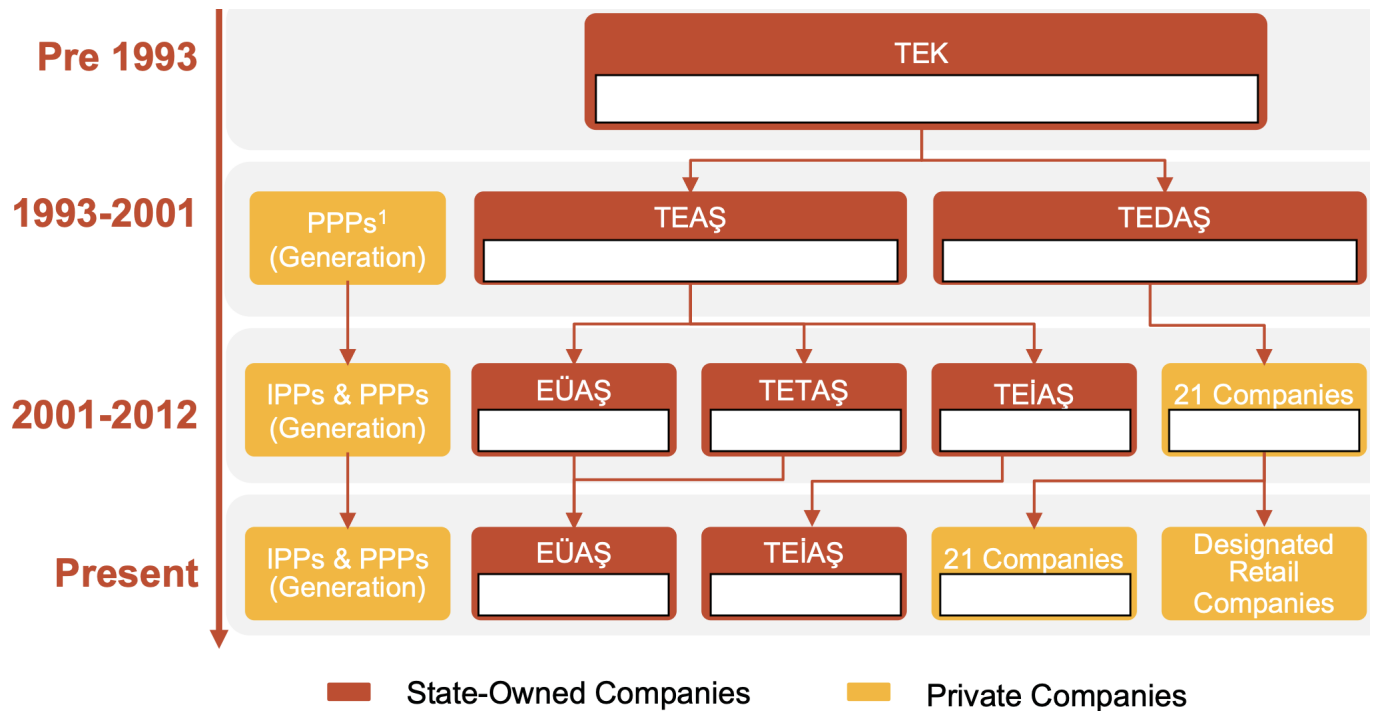


Figure 1: The evolution of Turkish electricity markets and actors

- (c) (5 points) Fill in the blanks with the appropriate terms regarding the Turkish Electricity Markets.

1. _____ Price: Day-Ahead Market
2. _____ Price: Intra-Day Market
3. _____ Price: Future Power Market
4. _____ Price: Balancing Power Market



(d) (10 points) Fill in the blanks with the appropriate terms.

- The fuel is fabricated from uranium ore. _____ power plant efficiency averages around 33% which means that 67% of the energy produced by the plant is lost and only 33% is converted into electricity. Some modern plants may be able to achieve 45% efficiency.
- Using lignite as a fuel, _____ power plant efficiency is very similar to the above, with a typical plant operating at 32% to 33% efficiency.
- Türkiye bridges Blue Stream, Iran-Türkiye, TANAP, and TurkStream natural gas pipelines from Asia to Europe. There are two different types of natural gas power plants. A _____ power plant efficiency rate tends to be the lower, ranging from 33% to 43%. On the other hand, a _____ power plant's efficiency can reach upwards of 60% because it captures and uses the plant's hot exhaust gases to spin a secondary turbine, which generates more electricity. The result is that less energy is lost in the conversion process.
- _____ power plants are the most efficient ones with a 90% efficiency rate. This is because dams funnel water directly to the turbines that generate the electricity, resulting in very little energy loss during the conversion process.

(e) (5 points) What does ICT stand for? Briefly list four applications of digital technology in the energy industry.

(f) (5 points) What do AI, DL, and ML stand for? Describe the relationship between the AI, DL, and ML.

(g) (10 points) Compare the three most popular data science languages, namely Julia, Python, and R in terms of the type of translator, the computational speed for scientific calculations, and the data visualisation skills.

Feature	Julia	Python	R
Translator	☐ Compiler ☐ Interpreter	☐ Compiler ☐ Interpreter	☐ Compiler ☐ Interpreter
Speed	☐ Slow ☐ Normal ☐ Fast	☐ Slow ☐ Normal ☐ Fast	☐ Slow ☐ Normal ☐ Fast
Visualisation	☐ Fair ☐ Elegant	☐ Fair ☐ Elegant	☐ Fair ☐ Elegant



2. Answer the following questions.

(a) **(5 points)** Should Julia, Python, or R be the main programming language of this course and why?

(b) **(10 points)** Develop a Julia function named as *findroot* that firstly requests coefficients of a quadratic function ($ax^2 + bx + c = 0$) from the user, then calculates Δ ($\Delta = b^2 - 4ac$) and finally computes the roots $x_{1,2}$ ($x_{1,2} = \frac{-b \pm \sqrt{\Delta}}{2a}$).

(c) **(5 points)** Some popular Julia packages are given below. Fill in the blanks with the appropriate package names.

1.jl : Calculating descriptive statistics
2.jl : Storing and manipulating tabular data
3.jl : Loading and saving CSV data
4.jl : Creating visualisations

(d) **(5 points)** Write the necessary Julia codes to create a zero array named as *ADS* having four elements, assign 1, 9, 4, and 0 one by one into the *ADS* array, calculate the average value of the array, and finally print the average.



According to Wikipedia, Graeme Souness is a Scottish former professional football player, manager, and television pundit. Souness went to manage Galatasaray in Türkiye in June 1995, and again managed to court controversy with local issues, nearly sparking a riot after placing a large Galatasaray flag into the centre circle of the pitch of arch rivals Fenerbahçe after Galatasaray had beaten them in the Turkish Cup final on 24 April 1996. The iconic image of Souness planting the flag drew comparisons with Turkish hero Ulubatlı Hasan, who was killed as he planted the Ottoman flag at the end of the Siege of Constantinople. This earned Souness the nickname “Ulubatlı Souness”. In Table 1, current table for the English Premier League is illustrated and tabulated in honour of Graeme Souness.

Table 1: Current Table for the English Premier League (GraemeSouness.csv)

Position	Club	Played	Won	Drawn	Lost	GF	GA	GD	Points
1	Arsenal	31	22	5	4	75	24	51	71
2	Liverpool	31	21	8	2	72	30	42	71
3	Manchester City	31	21	7	3	71	31	40	70
4	Tottenham Hotspur	31	18	6	7	65	45	20	60
5	Aston Villa	32	18	6	8	66	49	17	60

GraemeSouness.csv file is stored in your computer’s working directory.

- (e) **(5 points)** Import the CSV file and convert into a dataframe.
- (f) **(5 points)** Print the column names, the number of rows, and the number of columns in the data set.
- (g) **(5 points)** Sort the data set in a descending order according to the *GA* column.
- (h) **(10 points)** Fill in the blanks with the appropriate results according to *GraemeSouness.csv*. Which function is used to obtain the following table in Julia?

variable	mean	min	median	max
Club				
GF				
GA				
GD				
Points				