



Full Name : \_\_\_\_\_ Student ID: \_\_\_\_\_

Grade Table (for Lecturer use only)

Question	Points	Score
1	2	
2	4	
3	6	
4	8	
Total:	20	

### Instructions for Take-Home Exam

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

- You have exactly 3 days and 8 hours to solve the exam. It has to be received by me at 17:00 on 11 May 2020. ABSOLUTELY NO EXTENSIONS. Late submission will be severely penalised.
- The only option for submission is by e-mail (send to kzor@atu.edu.tr) with scanned and signed images by your own handwriting in one PDF file.
- E-mail problems will not be accepted as an excuse for late submissions. It is your responsibility to make sure that your e-mail works properly and that I receive the submission on time.
- This exam is “open book” which means you are permitted to use any materials handed out in class, your own notes from the course, the text book, and anything on the EEE110 - Computer Programming course website ([www.kasimzor.com.tr/eee110](http://www.kasimzor.com.tr/eee110)).
- The exam must be taken completely alone. Showing it or discussing it with anybody is forbidden, including (but not limited to) the other students in the course in current or previous years. It is also forbidden to use any solutions to similar problems from previous years as reference material.
- You may not consult any external resources. This means no internet searches, materials from other classes or books or any notes you have taken in other classes etc. You may not use Google or any other search engines for any reason. You may not use any shared Google documents. (You are NOT allowed to submit questions to internet discussion groups, though!).
- Make an effort to make your submission clear and readable. Severe readability issues may be penalised by grade.
- Integrate your code into the solution with comments and explanations. Even if the final result is wrong, the code may allow us to find the bug and award partial credit.
- Please sign the below Honour Code statement.

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. **(2 points)** Design a program that takes height (in m) or time (in s) values from the user and calculates either time or height in the state of free fall.
- Case 1: User types “findTime” as string, program asks user to enter height value in order to find time value.
  - Case 2: User similarly types “findHeight” as string, program asks user to enter time value in order to find height value.
  - Case 3: Program otherwise displays “Syntax error for input command”.

Hint:  $h = \frac{1}{2}gt^2$ ,  $t = \sqrt{\frac{2h}{g}}$ , and  $g = 9.81 \text{ m/s}^2$ .



2. (4 points) Write a 500-word essay that compares and contrasts C++ programming language with C, Java, or Python programming language.



3. (6 points) Electrical energy production from wind power is one of the fastest growing technologies and an economically viable option among renewable energy resources. Basically,  $E_{annual}$  which corresponds to the annual electrical energy (in Wh) generation from wind power is calculated as follows

$$E_{annual} = 8760C_F P_{wind} c_p$$

where  $C_F$ ,  $P_{wind}$ , and  $c_p$  stand for capacity factor, wind power (in W), and power coefficient respectively. Subsequently,  $P_{wind}$  can be yielded as

$$P_{wind} = \frac{1}{2} \rho \pi \left(\frac{D}{2}\right)^2 v^3$$

where  $\rho$  is the density of air (in  $\text{kg/m}^3$ ),  $D$  is the rotor diameter (in m), and  $v$  is the average wind speed (in m/s).

According to the aforementioned formulae, design a program that separately computes annual energy production of a wind turbine within two different auxiliary function named as *Onshore* and *Offshore* by considering the followings:

- Auxiliary functions shall be developed as
  - Return-type functions for students with odd student IDs,
  - Void functions for students with even student IDs.
- The density of air  $\rho$  and the average wind speed  $v$  shall be declared as *global constants* and sequentially equals to  $1.2 \text{ kg/m}^3$  and  $10 \text{ m/s}$ .
- User shall be initially informed to select and call either *Onshore* or *Offshore* auxiliary function wherein all computations shall be performed.
- The user shall enter  $D$ ,  $C_F$ , and  $c_p$  values in both *Onshore* and *Offshore* auxiliary functions.
- The conditions for the capacity factor  $C_F$ 
  - For onshore wind turbines:  $0.20 \leq C_F \leq 0.35$ ,
  - For offshore wind turbines:  $0.35 \leq C_F \leq 0.50$ ,shall be validated against erroneous entries by employing
  - *while* loops for students with odd student IDs,
  - *do-while* loops for students with even student IDs.
- The condition for the power coefficient  $c_p$  is  $0 < c_p \leq 0.593^*$  which shall be validated against erroneous entries by employing
  - *do-while* loops for students with odd student IDs,
  - *while* loops for students with even student IDs.

\*Please note that  $\frac{16}{27} \approx 0.593$  corresponds to the Betz limit which is the theoretical maximum power extraction efficiency for a wind turbine.



4. (8 points) Assume a hospital, which serves to a rural area in Iraq, is fed continuously by a group of diesel engine driven permanent magnet synchronous generators. The real electric output power of a synchronous generator can be expressed in line quantities as

$$P_{out} = \sqrt{3}V_L I_L \cos \theta$$

where  $V_L$  and  $I_L$  are the magnitudes of line voltage and current, while  $\cos \theta$  stands for power factor. Design a program by using *array* structure to define the number of generators  $n$  at first, then employing *pointer* structure for all other operations in order to compute and display the average output power of  $n$  number of generators, the lowest output power, and the highest output power (in kW) respectively by taking into account the following considerations:

- The line voltage  $V_L$  shall be declared as a *global constant* and corresponds to 0.4 kV.
- $n$ ,  $I_L$  (in A), and  $\theta$  (in  $^\circ$ ) values shall be entered by the user. It should be noted that  $I_L$  values frequently vary from one generator to another.
- The conditions for
  - $n \geq 1$ ,
  - $I_A > 0$ ,
  - $35^\circ \leq \theta \leq 40^\circ$

shall be validated against erroneous entries by utilising from

- *do-while* loops for students with odd student IDs,
- *while* loops for students with even student IDs.
- For the main repetition structure, students with
  - Odd student IDs shall use a *for* loop,
  - Even student IDs shall employ a *while* loop.