IE375 –Spring 2024
Comments on Exam I

General Comments:

This exam is reasonably standard and aims to evaluate your related knowledge and your performance on the basics of the current course. This exam required you to analyze numbers, as well as to approach some cases conceptually. Engineers work on data, so you must accumulate experience to understand, interpret, and utilize the "numbers" obtained.

The first two questions are on forecasting, which brings most of what you have covered in class. Questions 3 and 4 are on inventory planning.

This exam is a balanced one with questions:

1. Requiring you to apply known methodologies (Question 1, Question 3, Part a) through d).
2. To model or interpret a given environment (Question 4, Question 3, Part e) and finally.
3. Use your judgment to analyze and interpret (Question 2 Part b).

Crucial observation: You need to read the questions carefully. For one reason or another (test habits?), some of you still skip parts of the problem information stated in the beginning. Next time, please be more careful when reading and answering all the questions.

Another crucial observation: Some of you have not signed the honor code. Was it a willing act? Let me know if that was the case.

Please find some statistics on your exam results below. There is at least one full correct answer for each part of all questions, showing that the questions are doable.

Exam Results:

Mean: 61.4
Std. Dev.: 16.0
Max: 94
Min: 21

Frequency Distribution:

Range	**0-10**	**11-20**	**21-30**	**31-40**	**41-50**	**51-60**	**61-70**	**71-80**	**81-90**	**91-100**
Freq.	0	0	3	3	9	11	18	14	3	2

The frequency distribution of grades you have received for each of the questions are given below. Note that the mode of the exam is in the range 61-70, the interval that the average is ine, showing that it is a balanced exam.
Finally, if you received a grade which is below 50, I think you need to feel the pressure. Of course, for those of you who have received above 50, still we have a long way to go.

Question 1

This is a rather standard forecasting question, asked in a structural way. Note that if I ask an arbitrary forecasting question, to show the results in a similar tabular format will be neat.

Part a): Most of you started by finding smoothing constants. Most of you were able to find them correctly. I accepted some of the computational errors – that's understandable. However, if you obtained a smoothing constant value close to 1 (or in a few cases larger than one or less than zero) and if you haven't suspected from your computations, less partial (even no partial) grade was granted. Remaining part of the question required you to use the correct model (model with trend only) for your computations. No partials were granted if you used a wrong formula, indicating use of an incorrect model. Your effort to obtain each value asked was given equal points.

Part b) required you to forecast the items for Period 9 given the information of demand realized in Period 8. Unless you used the correct model, you were not granted any partial grades.

Part c) asked you to forecast far in the future and for the sum of four periods. The answer should not be any different than for part b); however, some of you changed the model used and gave mostly incorrect answers (though some corrected their mistakes in Part b!). If you didn't compute the sum you were taken off one point, just to check whether you are reading the question carefully. Among those who responded this part of the question (correctly or incorrectly), one third of them didn't take the sum!

Forecasting implementation is a simple process which requires use of equations in a certain order, first to update and then to forecast. Simple Excel type implementation is useful and most of the time sufficient.

Your performance was satisfactory in this question. A group of you were able to have full grades or almost full grades. The most frequently encountered mistake is not to use the correct model consistently throughout the parts. Formulas were supplied, but you need to know which ones to apply – it means you need to understand the models. If you used an incorrect model to estimate one of the parameters, you have not received any partial grade (for the part of the grade that is allocated to that parameter). Even if you used correct model, you made some computational errors which I find inevitable during short time periods like exams. No penalty was given for "small" computational errors, in general. However, if you have encountered an unreasonable numerical outcome, you should be able to observe it and correct it, even during an exam.

I didn't penalize some immaterial computational errors, but took some points off if they were far away from the correct value (and mostly a mistake that should be observed). In general, for such questions I would recommend you to use the earliest data to estimate, for example α and β, so that accumulated round-off errors would be the least.

For Part b) and Part c) if you used an incorrect model for computations no partial grades were granted. On the other hand, if you made some computational errors which may affect the outcome of the questions, as long as you were consistent no grades were taken off.

One final remark: A small number of answers for Part c) contained explanations like "we cannot forecast for the demand of Period 12, as the most recent information is given for Period 8". These are not reasonable, as you always forecast under available information – of course, the further in time you try to forecast, the lesser accuracy it will have.

The frequency distribution of grades you have received for the question are given below:

Range	**0-7**	**8-14**	**15-21**	**22-28**	**29-35**
Freq.	1	2	5	12	43

Other statistics on the results of this question are:

Mean: (out of 35) 29.7
Std. Deviation: 7.2
Max: 35
Min: 5

Now, probably you can analyze the above information, as well. The mode is in 29-35 range showing that the question was straightforward. This is why the average of the question is higher than the exam average. If the grade you received is 20 or below, I suggest you to start reviewing the forecasting chapter from scratch.

Question 2

This question is related to the measurement of the quality of forecasts. If you understand the solution, please record it, as this is one of the ways in real life to follow the quality of your forecasting system.

In Part a) you were asked to make computations regarding tracking signal. All the formulas were given here in this section, and hence there was no way of selecting an incorrect one. This part is very straightforward, and most of you have performed the computations correctly. Common mistakes were not considering absolute value of error in computing M_t, not using the given data, but making up data, and finally incorrect computations. Another less common mistake was to try to use the data from Question 1) and disregard the information given in Question 2).

In Part b) the question was to interpret the computed tracking signal values. Of course, to interpret you need to understand what tracking signal is about. Some of you did. The answer (with the correctly calculated T values) is simply to observe the increasing trend of the values - last one is exceeding 0.5, which is a rule-of-thumb threshold to declare the forecasting method used as biased. You were expected to say that the increasing trend with "large" T values mean that the demand model driving the forecasts is not an appropriate one. Incorrect answers were sometimes not granted any partial grades if it contained meaningless discussion without actually knowing the tracking signal (or understanding the formulas given above). On the other hand, even if your calculations were incorrect, as long as your answer was consistent with T values you computed full grade was granted.

Statistics on the results of this question are:

Mean: (out of 15):	12.1
Standard Deviation:	7.2
Max:	15
Min:	6

Frequency distribution:

Range	**0-2**	**3-5**	**6-8**	**9-11**	**12-15**
Freq.	0	0	5	19	39

Question 3

Part a) of the problem is relatively straightforward. Most calculated EPQ's are correct, although some students in the class used inconsistent units in the formula. They lost considerable points. I am not going to further comment on those. Those of you who used the regular EOQ were not granted any partial grades almost in all cases.

Part b) was phrased a little bit awkwardly – I admit that. Hence, some of you wrote answers which were not related to the manufacturing time within a cycle, but they still had full grades.

Part c) was asking for the cycle time.

Part d) asked a part of the average setup cost. I have granted **no** partial grades if you have only computed the average total cost (which includes the answer) and did not state anything else. My comment in the beginning about "not seriously reading the question" should be repeated here.

Part e) is more challenging – I admit. Nevertheless, the answer is simple: Consider a cycle. Part of the time within that cycle goes to manufacturing, keeping the machine busy. In the remaining part of the cycle, demand is satisfied using the inventory and cleaning operation on the machine can be performed. So, {the total time of a cycle - Part c) minus total time of manufacturing within a cycle -Part b)} will yield the maximum allowable cleaning time. I was a bit disturbed when I saw a lot of formulas from the rotational cycle policy (unfortunately memorized) flowing around – almost no or negligible partial grades were granted.

Statistics on the results of this question are:

Mean: (out of 30):	15.5
Standard Deviation:	7.4

Max: 30
Min: 0

Frequency distribution:

Range	**0-5**	**6-11**	**12-17**	**18-23**	**24-30**
Freq.	9	10	21	13	10

Not much to say. Once you read the comments, you probably would realize that you could have solved this question. If the grade you received is 15 or below, I suggest you to start reviewing the material.

Question 4

This question required you to formulate the given problem, a combination of an EOQ type environment with a continuous type price discount.

The formulation should have been straightforward if you followed the derivation of the EOQ model:

Here is the average profit function, answer to part a): $P\lambda - \{(b+a/Q)Q(\lambda/Q) + h(b+a/Q)Q/2\}$

Here are the explanations: The first term is the revenue received. Note that it is constant and will not affect the optimization. The second term in {} is the average cost term that resembles the EOQ formulation. The second term in the cost function is the average unit cost of ordering per unit time (variable cost per unit time X number of units bought X average number of cycles per unit time). Note that this term would be a constant for EOQ, as there would be no quantity discounts. The last term in the cost function is the average holding cost per unit time (inventory carrying cost per unit TL carried per unit time X value of a unit X average inventory). Note that this is almost the same as EOQ, except unit cost in EOQ is constant, whereas unit cost in this case is a function of Q.

Continuation of the problem required you to take the derivative of the above function (when you clean the above function, the result is almost similar to EOQ: $\sqrt{\{2a\lambda/hb\}}$ Unfortunately, your performance was unacceptable. Most of you received as low as zero or 1-2, as I didn't grant any partials if you were on a completely different page. The below standard deviation value shows this effect.

Common mistakes: Inserting cost parameters not stated in the problem; Modelling average cost (most modeled per cycle cost); not realizing that the problem is a perpetual one (infinite horizon).

I am very much disappointed with the performance of this question. If you cannot model simple situations (abstraction), then life as an IE will be challenging in the future.

The frequency distribution of grades you have received for the question is given below:

Range	**0-3**	**4-7**	**8-11**	**12-15**	**16-20**
Freq.	43	8	2	5	5

I think I do not need to add anything – numbers show the results.

Other statistics on the results of this question are:
Mean: (out of 20) 4.2
Standard Deviation: 5.6
Max: 20
Min: 0