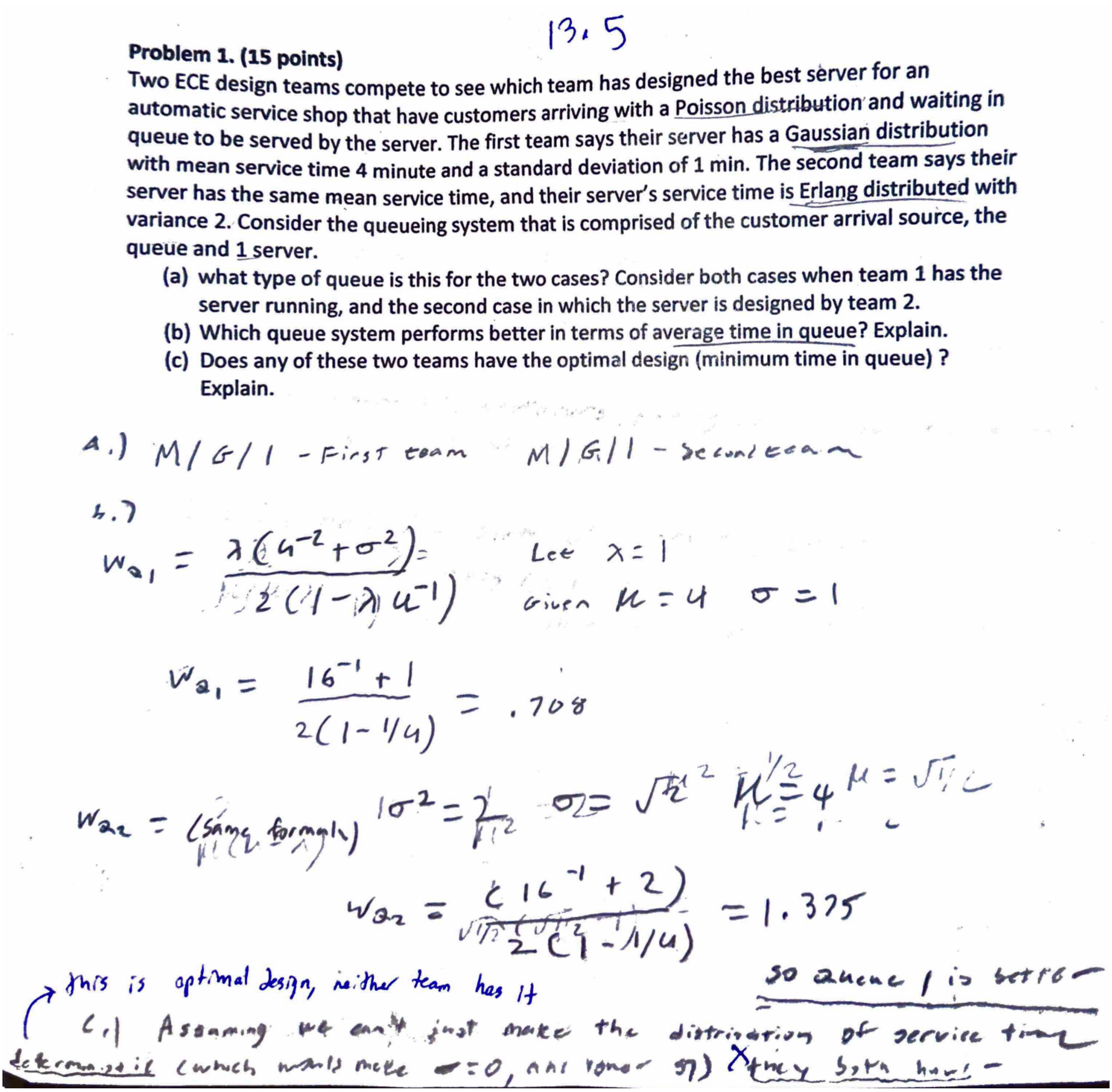
Midterm Regrade Requests

The annnouncement had said not to email you directly, but I had a questions about other problems on the exam as well so I'll put them all in one file so it's not to troublesome.

Problem 1 Part C

For Problem One, Part C, I wrote that they both have the optimal design because I assumed that you couldn't just magically make the service time deterministic (which I mentioned would be optimal as the variance would be zero) because I thought it would be weird to say that you can just command someone to work deterministically.



13.5

Problem 1. (15 points)
Two ECE design teams compete to see which team has designed the best server for an automatic service shop that have customers arriving with a Poisson distribution and waiting in queue to be served by the server. The first team says their server has a Gaussian distribution with mean service time 4 minute and a standard deviation of 1 min. The second team says their server has the same mean service time, and their server's service time is Erlang distributed with variance 2. Consider the queueing system that is comprised of the customer arrival source, the queue and 1 server.

(a) what type of queue is this for the two cases? Consider both cases when team 1 has the server running, and the second case in which the server is designed by team 2.
(b) Which queue system performs better in terms of average time in queue? Explain.
(c) Does any of these two teams have the optimal design (minimum time in queue) ? Explain.

a.) M/G/1 - First team   M/G/1 - second team

b.)

$W_{q_1} = \frac{\lambda(\mu^{-2}+\sigma^2)}{2(1-\lambda\mu^{-1})}$ Let $\lambda = 1$ Given $\mu = 4$ $\sigma = 1$

$W_{q_1} = \frac{16^{-1}+1}{2(1-1/4)} = .708$

W_{q_2} = (same formula)

$W_{q_2} = \frac{(16^{-1}+2)}{2(1-1/4)} = 1.375$

so queue 1 is better

this is optimal design, neither team has it

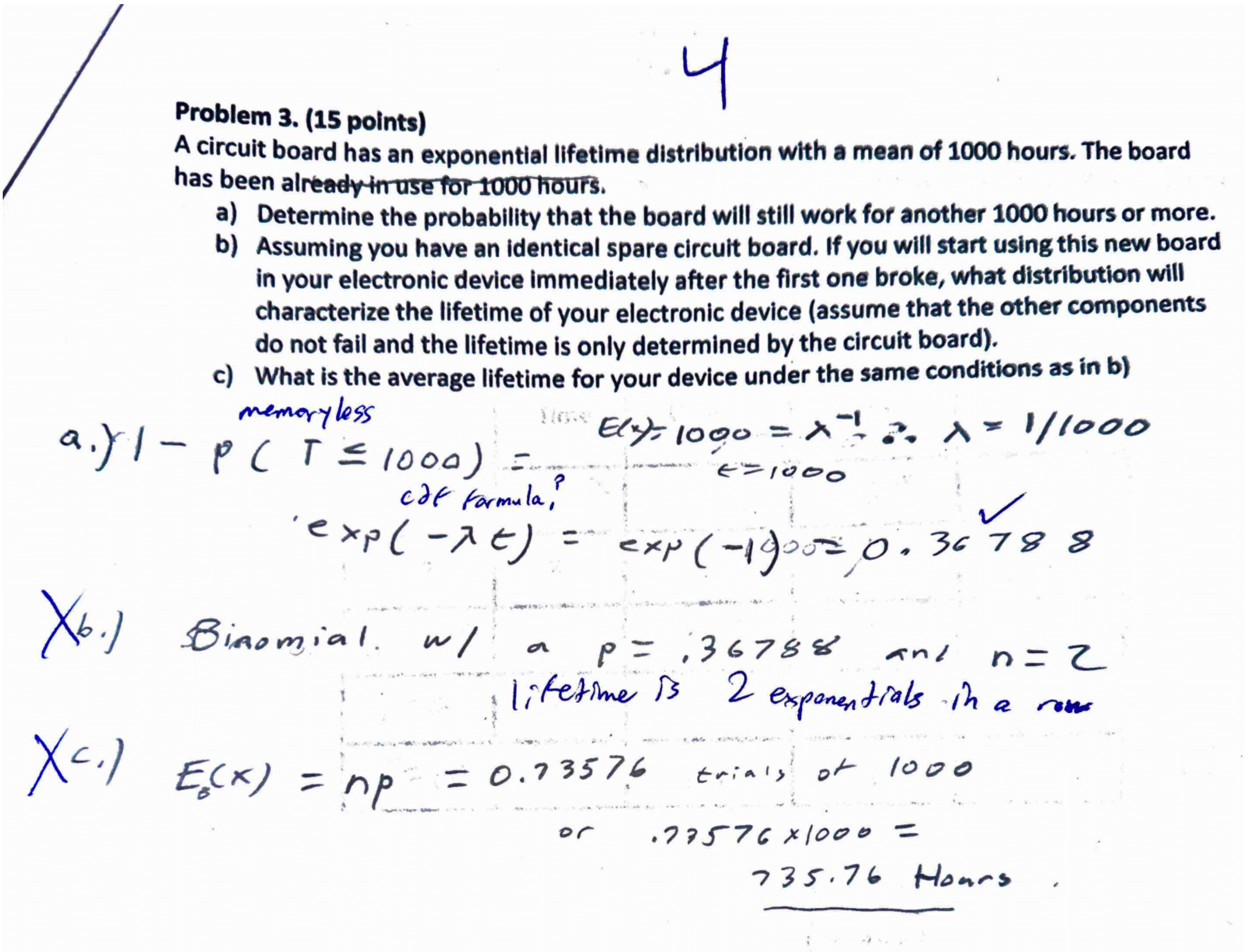
c.) Assuming we can't just make the distribution of service time deterministic (which would make $\sigma = 0$, and ...) they both have

Here is the text transcribed (if it's easier to read):

> Assuming we can't just make the distribution of service time deterministic (which would make σ = 0, and lower SD) they both have.

Problem 3

For Problem 3, I got a whole bunch of points off cause I incorrectly said the two boards would be binomial which caused me to get part C completely wrong. I was right to calculate E(x) but I put it in the binomial formula instead of the Erlang. I feel like I should have gotten some credit for at least having the idea correct.



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Problem 3. (15 points)
A circuit board has an exponential lifetime distribution with a mean of 1000 hours. The board has been ~~already in use for 1000 hours~~.

a) **Determine the probability that the board will still work for another 1000 hours or more.**
b) **Assuming you have an identical spare circuit board. If you will start using this new board in your electronic device immediately after the first one broke, what distribution will characterize the lifetime of your electronic device (assume that the other components do not fail and the lifetime is only determined by the circuit board).**
c) **What is the average lifetime for your device under the same conditions as in b)**

memoryless

a.) $1 - P(T \leq 1000) =$ $E(y) = 1000 = \lambda^{-1} \therefore \lambda = 1/1000$, $t = 1000$

cdf formula?

$\exp(-\lambda t) = \exp(-1) = 0.36788$ ✓

X b.) Binomial w/ a $p = .36788$ and $n = 2$

lifetime is 2 exponentials in a row

X c.) $E_B(x) = np = 0.73576$ trials of 1000

or $.73576 \times 1000 =$

735.76 Hours.

Extra Credit

Also my extra credit was discredited by a lot simply because I missed the part of the problem that said "two different sources" and did the problem for a lambda of 2 (instead of 4). I know it's extra credit so that's probably why it was graded that harshly, but I thought I might as well ask.

3, 5

Problem 5. Extra Credit (10 points)

Packets arrive at a network router from two different sources, each generating a Poisson stream with $\lambda = 2\frac{packets}{sec}$. The router processes and sends the packets with an exponential service distribution with a service rate of μ.

a) What type of queue is this?

b) What is the minimum service rate that the server should have, such that the time in queue experienced by the packets should be less or equal then 2 seconds?

a.) M / M / 1 Poisson arrivals exponential server

b.) $\cancel{\lambda = 2}$ $\lambda = 2+2=4$ $W_q \leq 2$

$W_Q = \frac{\lambda}{\mu(\mu-\lambda)}$ stability condition: $\mu > \lambda$

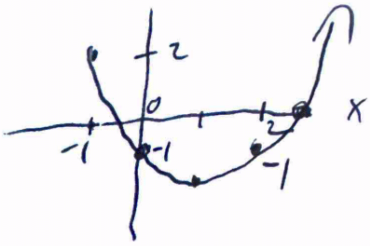
$2 = \frac{2}{\mu^2 - 2\mu}$ 4

$2\mu^2 - 4\mu - 2 = 0$ $\mu^2 - 2\mu - 1 = 0$

(graph this and find the intercepts w/ x axis. get positive x value

use quadratic formula to solve

I didn't bring my graphing calculator so I can't do it :(



$x \approx 2.5$

1 + 2 - 1

3 9 - X

4 - 4 - 1

so service time should be ~2.5 seconds

Conclusion

I would really appreciate it if you could look through my work. I studied pretty hard for this exam and I was really disappointed in myself for the score 🙁

Thank you for your time!

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