1. In the committee example, Section 11.1.3, consider the covariance matrix $C$ of the random vector $(G_1, G_2, G_3, G_4)'$.

(a) (20) Find the value of $C_{12}$, the element in row 1, column 2 of $C$. (Row and column numbers begin at 1.)

(b) (25) Suppose in our R code, we have already computed $C$, and we have stored the first two rows and columns in an R matrix we have named CG. Let $H_1 = G_1 + G_2$ and $H_2 = G_1 - 2G_2$. Give R code to find the covariance matrix of $H = (H_1, H_2)'$.

2. (25) Consider the setting in Section 9.3.2, with three electronic parts. Let $M$ denote the number of parts that last more than time 2.5. Find $\text{Var}(M)$.

3. (15) Suppose photographs in a certain setting are corrupted by small, straight streaks, the lengths of which have density $4t^3$ on $(0,1)$, 0 elsewhere. However, those checking the photographs are more likely to spot the longer ones, in proportion to the actual length; streaks twice as long, for instance, are twice as likely to be spotted. Give the density of the streaks that are noticed, expressed as an R function of $t$, i.e. `function(t)`

4. (15) Consider the Catchup Game, Section 11.2.1. Give a single, loop-free line of R code to print the approximate value of the probability that after `nturns` turns, the winning and losing sides are apart by less than 1.0.
Solutions:

1.a This is $\text{Cov}(G_1, G_2)$. From the computations already done in that section, we see that this is $5/12 - 4/9$.

1.b

\[
\begin{align*}
a & \leftarrow \text{rbind}(c(1,1), c(1,-2)); a \%*\% \text{CG} \%*\% t(a)
\end{align*}
\]

2. Binomial.

\[
p \leftarrow 1 - \text{pexp}(2.5, 1/2.5); 3*p*(1-p)
\]

3. Use (9.42).

\[
4 * t^3 / \text{integrate}(t^4* t^3, 0, 1)
\]

4.

\[
\text{print(} \text{mean(abs(xyvals[,1] - xyvals[,2]) < 1.0)}\text{)}
\]