STAT230 Homework 3

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1 Ch4, discussion 17

1.1

Using the bilinearity of the operator *cov*, we have:

$$
\begin{aligned}
var(S_n) &= cov(\sum_{i=1}^{n} X_i, \sum_{i=1}^{n} X_i) && (1)\\
&= \sum_{i=1}^{n} var(X_i) + \sum_{i \neq j} cov(X_i, X_j) && (2)\\
&= \sum_{i=1}^{n} \sigma^2 + \sum_{i \neq j} \sigma^2 r_{ij} && (3)\\
&= n\sigma^2 + \sigma^2 n(n-1)r && (4)\\
& && (5)
\end{aligned}
$$

1.2

$$
\begin{aligned}
var(\frac{S_n}{n}) &= \frac{var(S_n)}{n^2} && (6)\\
&= \sigma^2 + \frac{n-1}{n}\sigma^2 r && (7)
\end{aligned}
$$