Suppose \( \{x_t\} \) is a linear process, \( x_t = \sum u g_u e_{t-u} \), where \( \{e_t\} \) are iid with mean zero, variance \( \sigma_e^2 \).

and \( E[e_t^3] = \mu_3 \). Define \( \Gamma(\lambda) = \sum u g_u e^{-i\lambda u} \).

1) Show that \( \{x_t\} \) has spectral density \( f(\lambda) = \frac{\sigma_e^2}{2\pi} |\Gamma(\lambda)|^2 \).

2) Show that \( \{x_t\} \) has third moment function \( C(r,s) = E[xx_{t+r}x_{t+s}] \) given by \( C(r,s) = \mu_3 \sum u g_{u+r} g_{u+s} \).

3) Use the result of part 2 to show that \( \{x_t\} \) has bispectral density

\[
f(\lambda_1,\lambda_2) = \frac{1}{(2\pi)^2} \mu_3 \Gamma(-\lambda_1 - \lambda_2) \Gamma(\lambda_1) \Gamma(\lambda_2) .
\]

4) Show that

\[
\frac{|f(\lambda_1,\lambda_2)|^2}{f(\lambda_1)f(\lambda_2)f(\lambda_1+\lambda_2)}
\]

is constant (assuming \( \{x_t\} \) is linear), and that the value of the constant is \( \frac{\mu_3^2}{2\pi \sigma_e^6} \).