ECON 5345 Homework 2 Report

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Question 1

a. Q1

Question 2

a. Q2

Question 3

a. Q3

Question 4

a. The expectation is

$$\mathbb{E}[x_t] = \mathbb{E}[\alpha] \cos t + \mathbb{E}[\beta] \sin t$$
$$= 0.$$

The variance is

$$\mathrm{Var}[x_t] = \mathrm{Var}[\alpha] \cos^2 t + \mathrm{Var}[\beta] \sin^2 t + 2\,\mathrm{Cov}(\alpha, \beta) \cos t \sin t$$
$$= \cos^2 t + \sin^2 t$$
$$= 1.$$

The second line is by the independence of α and β.

b. No. Note that

$$\mathbb{E}[\alpha^2] = \mathrm{Var}[\alpha] + (\mathbb{E}[\alpha])^2$$
$$= 1$$
$$\mathbb{E}[\beta^2] = \mathrm{Var}[\beta] + (\mathbb{E}[\beta])^2$$
$$= 1$$
$$\mathbb{E}[\alpha\beta] = \mathrm{Cov}(\alpha, \beta) + \mathbb{E}[\alpha]\mathbb{E}[\beta]$$
$$= 0.$$

As a result, we have

$$\mathbb{E}[x_t x_{t-k}] = \mathbb{E}[\alpha^2] \cos t \cos(t - k) + \mathbb{E}[\beta^2] \sin t \sin(t - k)$$
$$+ \mathbb{E}[\alpha\beta][\cos t \sin(t - k) + \sin t \cos(t - k)]$$
$$= \cos t \cos(t - k) + \sin t \sin(t - k)$$
$$= \cos[t - (t - k)]$$
$$= \cos k.$$