Question Number	Scheme	Marks
3 (a)	It is not a statistic as it involves <u>unknown</u> [population] parameter	B1
		(1)
(b)	$\mathrm{E}(S)=\mathrm{E}\left(\frac{3}{5}X_1+\frac{5}{7}X_2\right)=\frac{3}{5}\mathrm{E}(X_1)+\frac{5}{7}\mathrm{E}(X_2)$	M1
	$=\frac{3}{5}\mu+\frac{5}{7}\mu=\frac{46}{35}\mu\neq\mu$ So S is a biased estimator for μ	A1
		(2)
(c)	$'\frac{46}{35}\mu'-\mu=\frac{11}{35}\mu$	B1ft
		(1)
(d)	$\mathrm{E}(Y)=a\mathrm{E}(X_1)+b\mathrm{E}(X_2)=\mu$ $\Rightarrow(a+b)\mu=\mu$	M1
	$a+b=1$	A1
		(2)
(e)	$\mathrm{Var}(Y)=a^2\mathrm{Var}(X_1)+b^2\mathrm{Var}(X_2)=\left(a^2+b^2\right)\sigma^2$	M1
	$\mathrm{Var}(Y)=\left(a^2+'(1-a)'^2\right)\sigma^2$	M1
	$\mathrm{Var}(Y)=\left(2a^2-2a+1\right)\sigma^2$ *	A1*
		(3)

	Notes	Total 9
(a)	**B1**	For a correct explanation Allow σ is unknown (Do not allow σ is unknown variance)
(b)	**M1**	For writing or using $\mathrm{E}(S)=a\mathrm{E}(X_1)+b\mathrm{E}(X_2)$ Condone missing subscripts
	A1	cao (Allow $1.31\mu\neq\mu$)
(c)	**B1ft**	Follow through their part (a) $-\mu$
(d)	**M1**	For writing or using $\mathrm{E}(Y)=a\mathrm{E}(X_1)+b\mathrm{E}(X_2)=\mu$ (May be implied by $a+b=1$) Condone missing subscripts
	A1	Cao
(e)	**M1**	For writing or using $\mathrm{Var}(Y)=a^2\mathrm{Var}(X_1)+b^2\mathrm{Var}(X_2)$ Condone missing subscripts
	M1	For substitution of $b=1-a$ ft their part (d) into their expression for Var(Y)
	A1*	Answer is given so no incorrect working must be seen