Week01-HW01

Q// $E[y] = E[Ax+b] = AE[x] + b$

$Cov[y] = Cov[Ax+b] = A\,Cov[x]\,A^T = A\Sigma A^T$

As, $E[y] = \sum_x y\, p_r(x)$

$\sum_x (Ax+b)\, p_r(x)$ $\quad\quad \because y = Ax+b$

$A\sum_x x\, p_r(x) + b\sum_x p_r(x)$

$AE[x] + b(1) = AE[x]+b$ Hence proved

Now, $Cov[y] = cov[Ax+b]$

$= E[Ax+b-\mu][Ax+b-\mu]^t$

$= E[Ax(Ax)^T] - E[Ax]\,E[Ax]^T$

$= E[AxA^Tx^T] - E[Ax]\,E[A^Tx^T]$

$= A[E[xx^T - E[x]E[x^T]\,A^T$

(Proved) $= A\,Cov[x]\,A^T$ $\quad\quad \because Cov[x] = E[xx^T] - E[x]E[x]^T$

(proved) $= A\Sigma A^T$

$\because$ Because Covariance matrix is also denoted by Sigma.