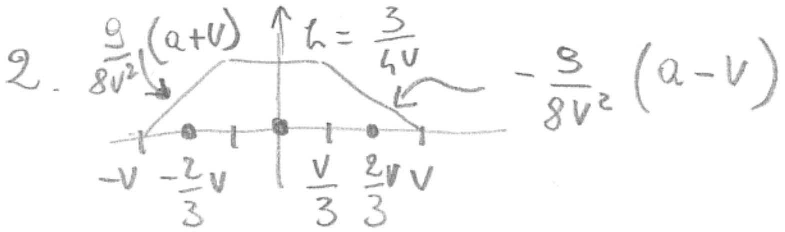
1. $$\sigma_x^2 = \int_0^{\frac{1}{T}} \left(1 + \cos 2\pi f T\right) df = \frac{1}{T}$$

$$P\left[x^2(kT) + x(kT) - 2 > 0\right] = P\left[\{x(kT) < -2\} \cup \{x(kT) > 1\}\right]$$
$$= P\left[x(kT) < -2\right] + P\left[x(kT) > 1\right] = \phi\left(-2\sqrt{T}\right) + Q\left(\sqrt{T}\right)$$

2. 

$$\frac{(B_M + b_m)\,h}{2} = 1 \Rightarrow h = \frac{3}{4V}$$

$$M_e = \int_{-V}^{-\frac{V}{3}} \left(a + \frac{2}{3}V\right)^2 \left(\frac{9}{8V^2}(a+V)\right) da +$$
$$\int_{-\frac{V}{3}}^{\frac{V}{3}} a^2 \, \frac{3}{4V}\, da + \int_{\frac{V}{3}}^{V} \left(a - \frac{2}{3}V\right)^2 \left(-\frac{9}{8V^2}(a-V)\right) da$$
$$= \frac{V^2}{27}$$

3. $c(kT) = a^2(kT)$ è a simboli indipendenti. Inoltre
$c(kT) \in \{0,1\}$, $P[c(kT)=0] = P[a(kT)=0] = 0.2$
$P[c(kT)=1] = 0.8$. $\sigma_c^2 = M_c - m_c^2$ $\quad M_c = 0.8$, $m_c = 0.8$
$b(kT)$ viene ottenuto da $c(kT)$ con il filtro
$$h(kT) = \delta_{Z(T)}(kT) - \delta_{Z(T)}(kT - T)$$
$$R_b(f) = R_c(f)\,|H(f)|^2 = \left(\sigma_c^2 \cdot T + m_c^2 \sum_k \delta_R\left(f - \frac{k}{T}\right)\right) \cdot$$
$$\cdot \left|1 - e^{-j2\pi f T}\right|^2 = 0.16T\,(2 - 2\cos 2\pi f T)$$
La parte a righe scompare in quanto
$$(2 - 2\cos 2\pi f T)\cdot \delta_R\left(f - \frac{k}{T}\right) = \left(2 - 2\cos 2\pi \frac{k}{T} T\right)\delta_R\left(f - \frac{k}{T}\right) = 0$$

4)

$$c(t) = A_M \, g * h(t)$$

h(t) e g(t) hanno estensione $\left(-\frac{T}{2}, \frac{T}{2}\right) \Rightarrow c(t)$ ha estensione $(-T, T)$, non c'è isi.

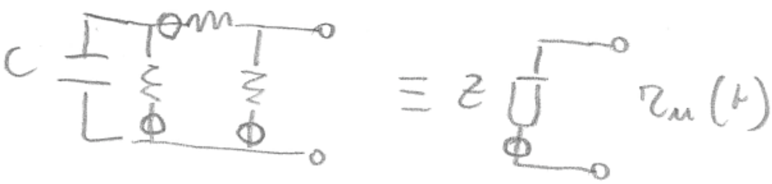
$$c(0) = A_M \cdot \int_{-\infty}^{+\infty} g(\tau) h(-\tau) \, d\tau = A_M \cdot h_0 V_0 \cdot \int_{-\infty}^{+\infty} \text{triangle}^2\left(\frac{2\tau}{T}\right) d\tau$$

$$= A_M h_0 V_0 \cdot 2 \cdot \frac{T}{2} \cdot \frac{1}{3} = \frac{1}{3} A_M h_0 V_0 T = V_0'$$

$$\sigma_n^2 = R_0 \cdot \int_{-\infty}^{+\infty} |H(f)|^2 df = R_0 \int_{-\infty}^{+\infty} h^2(t) \, dt = \frac{R_0 h_0^2 T}{3}$$

$$P_e = \frac{3}{2} Q\left(\frac{V_0'}{\sigma_n}\right)$$

5) Teorema di Nyquist



$$Z = \left((R /\!/ C) + R\right) /\!/ R$$

$$R /\!/ C = \frac{R}{1 + j 2\pi f R C} \qquad Z = \frac{\left(\frac{R}{1 + j 2\pi f R C} + R\right) R}{2R + \frac{R}{1 + j 2\pi f R C}}$$

$$= \frac{2R + j 2\pi f R^2 C}{3 + j 4\pi f R C}$$

$$R_{v_n}(f) = 2kT \cdot \mathrm{Re}[Z(f)] = \frac{6R + 8\pi^2 f^2 R^3 C^2}{9 + 16\pi^2 f^2 R^2 C^2} \, 2kT$$