Question 1

By the definition in the textbook, we know that the effective (absolute) interest rate of a given investment of duration $T = 10$ years is the rate R such that

$$\boxed{(1 + r\delta t)^{\frac{T}{\delta t}} I_0 = I_F = (1 + R) I_0}$$

Then we know that $I_0 = 11$ Gils, $I_F = 15$ Gils and $T = 10$ years, we can get (with 2 decimal digits)

$$\boxed{R = 0.36}$$

So the absolute interest rate is 0.36.

Question 2

We know the value of bank account with the nominal interest rate r and compounding period δt is

$$\boxed{C_t = (1 + r\delta t)^{\frac{t}{\delta t}} C_0}$$

With $r = 2$ %.year^{-1}, $\delta t = 6$ months $= 0.5$ year, $C_0 = 10$ Gils and $t = 1$ year. Then we get (with 0 decimal digit)

$$\boxed{C_t = 10 \; Gils}$$

So the value of my bank account when I close it which is 1 year later is 10 Gils (with 0 decimal digit). That means I almost cannot get any profit from the bank. And if it is necessary to count with the profit, it is too small respect to $C_0 = 10$ Gils.

Question 3

This question require us to calculate the present value. According to the formula

$$\boxed{C_t = (1 + r\delta t)^{\frac{t}{\delta t}} C_0}$$

This time we have $C_t = 10$ Gils, $r = 1\%$ per period and $\delta t = 1$ months $= \frac{1}{12}$ year. Then the result is (with 2 decimal digits)

$$\boxed{C_0 = 9.80 \; Gils}$$

That means $C_0 = 9.80$ Gils is the value $C_2 = 9.80$ Gils when 2 months after.

Question 4

We can calculate the value of bank account after $t = 1$ year buying this two product represently. So we need to use the formula showed previously which is

$$\boxed{C_t = (1 + r\delta t)^{\frac{t}{\delta t}} C_0}$$

Since $t = t^A = t^B = 1$ year, $C_0 = 10$ Gils. Next we calculate the value represently.

1. Bank A

We can get that (with 3 decimal digits)

$$\begin{aligned} C_t^A &= (1 + 1\% \cdot \frac{1}{6})^6 \cdot C_0 \\ &= 1.01004 \times 10 \\ &= 10.100\ Gils \end{aligned}$$

2. Bank B

We can get that (with 3 decimal digits)

$$\begin{aligned} C_t^B &= (1 + 2\% \cdot \frac{1}{4})^4 \cdot C_0 \\ &= 1.02015 \times 10 \\ &= 10.202\ Gils \end{aligned}$$

So we can find $\boxed{C_t^A = 10.100\ Gils}$, $\boxed{C_t^B = 10.202\ Gils}$. Camparing this 2 value, we can easily find that $C_t^A < C_t^B$. So the product in bank B can get more value than in bank A. We can claim that the product in bank B is more advantageous.

Question 5

According to the payoff formula about American call option which is

$$\boxed{\xi = g(X_T) = (K - X_T)^+}$$

If I exercise my option now with current price $X_0 = 100$ Gils and strike $K = 90$ Gils I can get the payoff

$$\boxed{\xi_0 = 10\ Gils}$$

Since the derivative is an American call option, and we can exercise is at any time, we can get the payoff $\xi_0 = 10$ Gils if we exercise now at $t = 0$.