(c)

(i)

The duration of bond A is

$$D_A = \frac{15/(1+10\%)}{118.95} \times 1 + \frac{15/(1+10\%)^2}{118.95} \times 2 + \frac{15/(1+10\%)^3}{118.95} \times 3 + \frac{15/(1+1\%)^4}{118.95} \times 4 + \frac{115/(1+10\%)^5}{118.95} \times 5 = 3.95$$

Similarly, we can find the duration of bond B is

$$D_B = \frac{15/(1+10\%)}{130.72} \times 1 + \frac{15/(1+10\%)^2}{130.72} \times 2 + \frac{15/(1+10\%)^3}{130.72} \times 3 + \ldots + \frac{115/(1+10\%)^{10}}{130.72} \times 10 = 6.28$$

Suppose the proportion of bond A in the portfolio is x and the proportion of bond B is $1-x$, then we want the duration of the portfolio to be 5 years.

$$x \times 3.95 + (1-x) \times 6.28 = 5$$
$$x = 0.549$$

So the proportion of bond A in the portfolio is 54.9% and the value of bond A in the portfolio is $\$620901.16 \times 54.9\% = \$340874.7$, which is $\$340874.7/\$118.95 = 2865.7$ units of bond A. Similarly, we should buy $\$620901.16 \times (1-54.9\%)/\$130.72 = 2142.2$ units of bond B.

(ii)

Based on (i), we know the cash flow of the coupon of bond A is $2865.7 \times \$15 = \$42985.5$. Similarly, the cash flow of the coupon of bond B is $2142.2 \times \$15 = \$32133$.

We can easily calculate the accumulated value of these cash flows at the end of the fifth year as

$$(\$42985.5 + \$32133) \times (1+r)^4 + \ldots + (\$42985.5 + \$32133) \times (1+r) + (\$42985.5 + \$32133) + FV_A \times N_A + FV_B \times N_B + \frac{\$32133}{1+r} + \ldots + \frac{\$32133}{(1+r)^5}$$

When $r = 10\%$, we have the future value in the fifth year as $1,000,000.

If $r = \%9$, we have the future value in the fifth year as $1,000,347.

If $r = 11\%$, we have the future value in the fifth year as $1,000,283.

Clearly, the three future values are close.