

- 1) Huntington Bank offers an account that pays 4%, compounded daily. They decide to change to compounding four times a year. What interest rate should they offer to obtain the same annual effective rate as the original account?

(10 pts)

$$\left(1 + \frac{.04}{365}\right)^{365} = \left(1 + \frac{j^{(4)}}{4}\right)^4$$

$$1.040808493^{(1/4)} - 1 = \frac{j^{(4)}}{4}$$

$$\frac{j^{(4)}}{4} = .010049614$$

$$j^{(4)} = .040198455$$

- 2) On January 1, I win a prize that pays \$P at the **beginning** of each month for 10 years with the first payment starting immediately. Find \$P given that the present value of my prize at 3% interest compounded monthly is \$1,000,000.

(10 pts)

$$1,000,000 = \frac{(1 - (1 + \frac{.03}{12})^{-120})}{\frac{.03}{12}} (1 + \frac{.03}{12}) \cdot P$$

$$1,000,000 = 103.82065716P$$

$$P = \$9631.99$$

- 3) First Bank pays 4% interest, **compounded daily**. I open an account on January 1 by depositing 10,000. Thereafter, I deposit \$200 at the end of each month for 5 years for a total of 60 deposits. What is the balance in my account immediately after the 60th deposit? Assume that each month has 365/12 days.

(10 pts)

$$\left(1 + \frac{.04}{365}\right)^{365} = \left(1 + \frac{i^{(12)}}{12}\right)^{12}$$

$$\frac{i^{(12)}}{12} = .003338712$$

$$10,000 \left(1 + \frac{i^{(12)}}{12}\right)^{60} + 200 \left(\frac{\left(1 + \frac{i^{(12)}}{12}\right)^{60} - 1}{\frac{i^{(12)}}{12}}\right)$$

$$12213.89387 + 13261.96371 =$$

$$\$25475.86$$

4) An account earns 5% annual effective discount for the first two years, 3% annual effective interest for the third year and 4% annual effective force of interest for the last three years. What is the annual effective interest rate on the account?

(10 pts)

$$(1+i)^6 = \left(1 + \frac{.05}{.95}\right)^2 \cdot (1+.03) \cdot (e^{.04})^3$$

$$(1+i)^6 = 1.286783111$$

$$i = 4.291975\%$$

- 5) You borrow \$150,000 to buy a house which you finance with a 30 year loan at 3% interest, compounded monthly, on which you pay \$632.40 at the end of each month. How much do you owe at the end of the second year—i.e. immediately after the 24th payment?
(10 pts)

$$150,000 \left(1 + \frac{.03}{12}\right)^{24} - 632.40 \left(\frac{\left(1 + \frac{.03}{12}\right)^{24} - 1}{.03/12}\right)$$

$$159263.56 - 15622.06$$

$$\$ 143641.50$$

- 6) In problem 5, immediately after the 24th payment, I refinance the loan obtaining a 28 year loan at 2% interest, compounded monthly. Assuming that the answer to Problem 5 is \$100,000 (which is not correct), find the new monthly payment.
(10 pts)

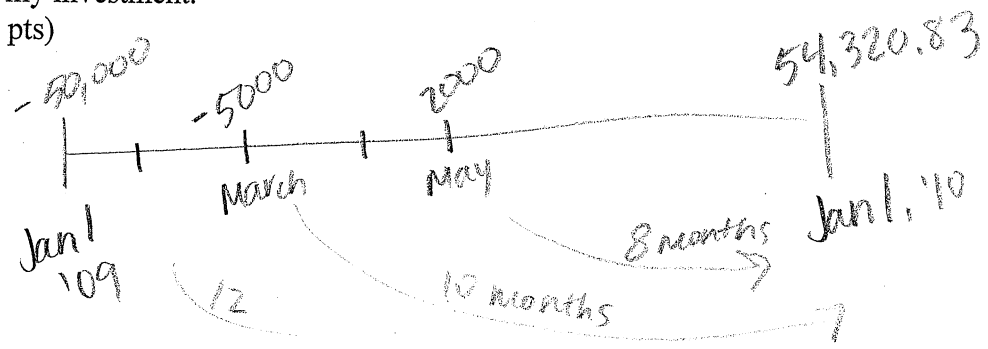
$$100,000 = P \left(\frac{1 - \left(1 + \frac{.02}{12}\right)^{-336}}{\frac{.02}{12}} \right)$$

$$100,000 = P \cdot 257.1147636$$

$$P = \$388.93$$

7) I bought \$50,000 of RC Penney stock on January 1, 2009. I bought \$5000 worth of RC Penney stock on March 1 and sold \$2000 of RC Penney stock on May 1. On January 1, 2010, I sold all of my RC Penney stock for \$ 54,320.83. Approximate the rate of return on my investment.

(10 pts)



$$54\,320.83 = -2000(1+i)^{8/12} + 5000(1+i)^{10/12} + 50,000(1+i)^{12/12}$$

$$54\,320.83 = -2000\left(1 + \frac{2}{3}i\right) + 5000\left(1 + \frac{5}{6}i\right) + 50,000(1+i)$$

$$1320.83 = \frac{-4000}{3}i + \frac{25000}{6}i + 50,000i$$

$$1320.83 = \frac{317000}{6}i$$

$$2.5\% = i$$

- 8) What price should you pay for a \$4,000 redemption value, 10 year bond which has \$100 quarterly coupons, assuming that you want a 2% yield, compounded quarterly?
(10 pts)

$$P = 100 \left(\frac{1 - \left(1 + \frac{.02}{4}\right)^{-40}}{\frac{.02}{4}} \right) + 4000 \left(1 + \frac{.02}{4}\right)^{-40}$$

$$P = 3617.22 + 3276.56$$

$$P = \$6893.78$$

- 9) The bond in question ⁸ (8) is sold after two years, immediately after the payment of the coupon, to an investor wanting a 1% yield, compounded quarterly? What should the selling price of the bond be?
(10 pts)

$$P = 100 \left(\frac{1 - \left(1 + \frac{.01}{4}\right)^{-32}}{.01/4} \right) + 4000 \left(1 + \frac{.01}{4}\right)^{-32}$$

$$P = 3071.66 + 3692.83$$

$$P = \$6764.49$$

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10) The Piggy Bank pays 4% interest, compounded monthly.. From January 2000 to December 2010, I invested 200 per month into an account at the Piggy Bank at the beginning of each month. Beginning in January 2011, I increased by monthly deposits to 300 per month at the beginning of the month. What will be my total accumulation on December 31, 2015? (10 pts)

$$200 \left(\frac{\left(1 + \frac{.04}{12}\right)^{12 \times 11} - 1}{.04/12} \right) \left(1 + \frac{.04}{12}\right) \left(1 + \frac{.04}{12}\right)^{12 \times 5}$$
$$+ 300 \left(\frac{\left(1 + \frac{.04}{12}\right)^{12 \times 5} - 1}{.04/12} \right) \left(1 + \frac{.04}{12}\right)$$
$$= 40542.7092 + 19955.99243$$
$$= 60498.70163$$

Total accumulation → \$60,498.70