第一部分:單選題（共七十五分）。注意： 此一大題應作答於「答案卡」。

※ 注意：請用 2B 鉛筆作答於答案卡，並先詳閱答案卡上之「畫記說明」。

1. (8 points) Suppose $a_1, \ldots, a_k$ are orthonormal n-vectors, and $x = \beta_1 a_1 + \cdots + \beta_k a_k$, where $\beta_1, \ldots, \beta_k$ are scalars. Express $\|x\| = \sqrt{x_1^2 + x_2^2 + \cdots + x_n^2}$ in terms of $\beta = (\beta_1, \ldots, \beta_k)$.

   (A) $\sum_{i=1}^{k} \beta_i$

   (B) $\sum_{i=1}^{k} {\beta_i}^2$

   (C) $\sqrt{\sum_{i=1}^{k} {\beta_i}^2}$

   (D) $\sqrt{\sum_{i=1}^{k} \sum_{j=1}^{k} \beta_i \beta_j}$

   (E) $\sqrt{\left(\sum_{i=1}^{k} \sum_{j=1}^{k} \beta_i \beta_j\right) - \left(\sum_{i=1}^{k} \beta_i^2\right)}$

2. (8 points) Which of the following matrices is positive definite? (A symmetric matrix A is positive definite if and only if $x^T A x > 0$ for all $x \neq 0$)

   $$A_1 = \begin{bmatrix} -1 & 2 & 3 \\ 2 & 5 & -3 \\ 3 & -3 & 2 \end{bmatrix}.$$

   $A_2 = I - uu^T$ where u is an n-vector with $\|u\| < 1$.

   $A_3 = \begin{bmatrix} I & B \\ B^T & I + B^T B \end{bmatrix}$ where B is an $m \times n$ matrix.

   (A) A_1 only.

   (B) A_2 only.

   (C) A_3 only.

   (D) A_2 and A_3 only.

   (E) A_1, A_2, and A_3.

3. (8 points) Which of the following matrices has linearly dependent columns?

   $A_1 = \begin{bmatrix} D \\ B \end{bmatrix}$, where B is $m \times n$ and D is a diagonal $n \times n$ matrix with nonzero diagonal elements.

   $A_2 = ab^T$ where a and b are n-vectors and $n > 1$.

   $A_3 = I - ab^T$ where a and b are n-vectors with $\|a\|\|b\| < 1$.

   (A) A_1 only.

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(B) A_2 only.

(C) A_3 only.

(D) A_1 and A_2 only.

(E) A_2 and A_3 only.

4. (10 points) Let S be a square matrix that satisfies $S^T = -S$. This is called a skew-symmetric matrix. Which of the following statements is true?

I. $I - S$ is nonsingular.

II. $(I + S)(I - S)^{-1} = (I - S)^{-1}(I + S)$.

III. The matrix $A = (I + S)(I - S)^{-1}$ is orthogonal.

(A) I only.

(B) I and II only.

(C) I and III only.

(D) II and III only.

(E) I, II, and III.

5. (8 points)

$y''' - 2y'' - y' + 2y = 0;$

$y(0) = 2, \ y'(0) = 3, \ y''(0) = 5.$

Which of the following values is closest to $y(3)$?

(A) 424

(B) 444

(C) 464

(D) 827

(E) 867

6. (8 points)

$9y'' + 12y' + 4y = 0;$

$y(0) = -3, \ y'(0) = 3.$

Which of the following values is closest to $y(2)$?

(A) -1.3180

(B) -0.5134

(C) -0.2636

(D) 0.7908

(E) 1.5402

7.　(5 points) The pecking order theory states that companies should use _____ as their last resort of financing.

(A) equity

(B) corporate bonds

(C) internal financing

(D) bank loans

(E) venture capital

8.　(5 points) Which of the following statements is *incorrect*?

(A) IPO underpricing is related to firms' negative signaling motives.

(B) IPO underpricing is not limited to the U.S. financial markets.

(C) IPO underpricing may be related to winner's curse.

(D) IPO underpricing is the increase in stock value from the initial offering price to the first-day closing price.

(E) IPO underpricing may be caused by investor over-reaction causing spikes on the initial days of trading.

9.　(5 points) If you invest $100 for 3 years at 12% compounded quarterly, your investment will grow to?

(A) $140.58

(B) $142.58

(C) $144.58

(D) $146.58

(E) $148.58

10.　(5 points) What is the effective annual rate of return (EAR) of your investment in the previous question?

(A) 10.55%

(B) 12.55%

(C) 14.55%

(D) 16.55%

(E) 18.55%

11.　(5 points) Post-earnings-announcement drift is the tendency for a stock's cumulative abnormal returns to drift in the direction of an earnings surprise for several weeks or even several months following an earnings announcement. Which of the following statement best characterizes this phenomenon?

(A) Investors over-react to information contained in earnings announcements.

(B) Investors under-react to information contained in earnings announcements.

(C) Investors are overconfident in their stock-selecting skills.

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(D) Investors are indifferent to firms' capital structures.

(E) Capital structure is always irrelevant.

第二部分：填空題（共二十五分）

注意事項：

※※<u>非選項</u>問題(第12題)，請詳列計算過程(請至少計算至小數點後第二位)，若只有答案將不予計分※※

※※答案請於答案卷(本)上標示清楚，如 ANS:___XXXXXX___※※

※※一律作答於所附之考試答案卷(本)上。若於試題卷上作答者，將不予計分※※

※※第12題(共兩小題)各5分，其餘大題每題5分※※

12. You purchased a zero-coupon bond that has a face value of $1,000, five years to maturity, and a yield to maturity of 5.5%. It is one year later and similar bonds are offering a yield to maturity of 6.77%. You will sell the bond now. You have a tax rate of 25% on regular income and 25% on capital gains.
Calculate the following for this bond:
The before-tax rate of return on this investment? _(1)_
The after-tax rate of return on this investment? _(2)_

13. The free cash flow to the firm is reported as $177 million. The interest expense to the firm is $6 million. If the tax rate is 31% and the net debt of the firm increased by $17 million, what is the approximate market value of the firm if the free cash flow to equity grows at 4% and the cost of equity is 11%?

(A) $1,795 billion
(B) $2,712 billion
(C) $2,568 billion
(D) $2,793 billion
(E) $2,821 billion

14. Three years ago you purchased a bond for $988. The bond had three years to maturity, a coupon rate of 7.5%, paid annually, and a face value of $1,000. Each year you reinvested all coupon interest at the prevailing reinvestment rate shown in the table below. Today is the bond's maturity date. What is your realized compound yield on the bond?

Time	Prevailing reinvestment rate
0 (purchase date)	6.11%

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1	7.22%
2	8.33%
3	9.44%

(A) 5.19%
(B) 6.54%
(C) 7.96%
(D) 8.15%
(E) 9.37%

15. Next year's earnings are estimated to be $29. The Golbat company plans to reinvest 14% of its earnings at 9%. If the cost of equity is 7%, what is the present value of growth opportunities?

(A) $20.21
(B) $29
(C) $90.94
(D) $414.29
(E) $505.23
(F) $434.49