King Fahd University of Petroleum and Minerals
Department of Mathematics

[Master] **[Master]**

Math 105
Major Exam II
Term 222
April, 1, 2023
Net Time Allowed: 90 Minutes

Name ID .

Check that this exam has 15 questions.

Important Instructions:

1. All types of smart watches or mobile phones are NOT allowed during the examination.
2. Use HB 2.5 pencils only.
3. Use a good eraser. DO NOT use the erasers attached to the pencil.
4. Write your name, ID number and Section number on the examination paper and in the upper left corner of the answer sheet.
5. When bubbling your ID number and Section number, be sure that the bubbles match with the numbers that you write.
6. The Test Code Number is already bubbled in your answer sheet. Make sure that it is the same as that printed on your question paper.
7. When bubbling, make sure that the bubbled space is fully covered.
8. When erasing a bubble, make sure that you do not leave any trace of penciling.

Q1

Suppose a manufacturer of printed circuits has a stock of 200 resistors, 120 transistors and 150 capacitors and is required to produce two types of circuits.

Type A requires 20 resistors, 10 transistors and 10 capacitors.

Type B requires 10 resistors, 20 transistors and 30 capacitors.

If the profit on type A circuits is £5 and that on type B circuits is €12. What is the maximum profit?

a) 66
b) 60
c) 70
d) 50
e) 40

Q2

Maximize $Z = 2x + 6y$

Subject

$x - y \leq 4$

$-x + y \leq 4$

$x + y \leq 6$

$x, y \geq 0$

a) 32
b) 30
c) 33
d) 24
e) 8

Q3

Use the simplex method to find the maximum value of

$z = 2x_1 - x_2 + 2x_3$ Objective function

subject to the constraints

$2x_1 + x_2 \leq 10$

$x_1 + 2x_2 - 2x_3 \leq 20$

$x_2 + 2x_3 \leq 5$

where $x_1, x_2, x_3 \geq 0$

a) Maximum 15 at $x_2 = 0, x_3 = \frac{5}{2}$
b) Maximum 15 at $s_1 = 5, x_3 = \frac{5}{2}$
c) Maximum 15 at $x_2 = 5, x_3 = \frac{5}{2}$
d) Maximum 15 at $x_1 = 5, x_3 = 0$
e) Maximum 14 at $x_2 = 5, x_3 = \frac{5}{2}$

Q4 The last simplex table for a dual maximum problem is set as:

Table

	y_1	y_2	y_3	s_1	s_2	w	R
y_2	0	1	-4	1	2	1	3
y_1	1	0	13	1	2	2	2
w	0	0	20	5	6	1	20

Then the solution of primal minimization problem is

a) 20 at $x_1 = 5, x_2 = 6$
b) 1 at $x_1 = 2, x_2 = 3$
c) 20 at $x_1 = 3, x_2 = 2$
d) 20 at $x_1 = 6, x_2 = 5$
e) 1 at $x_1 = 5, x_2 = 6$

Q5

How long will it take for $500 to amount to $1000 if invested at 6% compounded monthly? Express the answer in years.

a) 12 years
b) 11 years
c) 13 years
d) 139 years
e) 10 years

Q6

A major credit-card company has a finance charge of 2 % per 6 months on the outstanding indebtedness. What is the effective rate?

a) 0.0201
b) 0.0210
c) 0.2010
d) 0.0211
e) 0.0220

Q7

An initial investment of $35,000 in a business guarantees the following cash flows:

Year	Cash Flow
5	$13,000
6	$14,000
7	$15,000

Assume an interest rate of 4% compounded quarterly. Find the net present value of the cash flows.

a) -1967.46
b) 1967.46
c) -1966.76
d) -4674.79
e) -1960.46

Q8

If interest is compounded continuously, at what annual rate will a principal **triple** in 20 years? Give the answer as a percentage correct to two decimal places.

a) 5%
b) 6%
c) 4%
d) 2%
e) 3%

Q9

Suppose $50 is placed in a savings account at the end of each month for four years. If no further deposits are made, how much is in the account after six years? Assume that the savings account pays 6% compounded monthly.

a) $3048.85
b) $2704.9
c) $2700.9
d) $3040.85
e) $618.2

Q10

A debt of $6000 due in five years is to be repaid by a payment of $2000 now and a second payment at the end of five years. How much should the second payment be if the interest rate is 8% compounded semiannually?

a) $3039.51
b) $3000.51
c) $2530.46
d) $2500.46
e) $3030.51

Q11

The compound interest of an annuity consisting of payments of $50 at the end of every three months for three years at the rate of 6% compounded quarterly.

a) 52.06
b) 50.06
c) 51.05
d) 50
e) 50.06

Q12

The present value of the annuity $900 paid at the beginning of each six-month period for seven years at the rate of 8% compounded semiannually is

a) 9887.08
b) 9987.08
c) 9890.08
d) 9888.08
e) 9880.08

Q13

On a history exam, each of six items in one column is to be matched with exactly one of eight items in another column. No item in the second column can be selected more than once. In how many ways can the matching be done?

a) 20160
b) 840
c) 56
d) 40320
e) 48

Q14 For the word ARABIA, how many distinguishable permutations of the letters are possible?

a) 120
b) 360
c) 720
d) 30
e) 1296

Q15

A biology instructor includes several true-false questions on quizzes. From experience, a student believes that half of the questions are true and half are false. If there are 12 true-false questions on the next quiz, in how many ways can the student answer half of them "true" and the other half "false"?

a) 924
b) 665280
c) 720
d) 132
e) 72

For an original principal of P, the formula

$$S = P(1 + r)^n \tag{1}$$

gives the **compound amount** S at the end of n *interest periods* at the *periodic rate* of r.

The **effective rate** r_e that is equivalent to a nominal rate of r compounded n times a year is given by

$$r_e = \left(1 + \frac{r}{n}\right)^n - 1 \tag{3}$$

The principal P that must be invested at the periodic rate of r for n interest periods so that the compound amount is S is given by

$$P = S(1 + r)^{-n} \tag{1}$$

and is called the **present value** of S.

$$S = Pe^{rt} \qquad r_e = e^r - 1$$

The formula

$$A = R \cdot \frac{1 - (1 + r)^{-n}}{r} \tag{1}$$

gives the **present value** A of an ordinary annuity of R per payment period for n periods at the interest rate of r per period.

$$S = R \cdot \frac{(1 + r)^n - 1}{r}$$

$$_nP_r = \frac{n!}{(n - r)!} \qquad _nC_r = \frac{n!}{r!(n - r)!} \qquad \frac{n!}{n_1!n_2! \cdots n_k!}$$