King Fahd University of Petroleum and Minerals
Department of Mathematics

MATH 105

Major Exam II

213

26 July 2022

Net Time Allowed: 120 minutes

MASTER VERSION

1. Consider the following Linear Programming problem.
Maximize

$$Z = 2x_1 + x_2 - x_3$$

Subject to

$$\begin{cases} x_1 + x_2 & \leq & 1 \\ x_1 - 2x_2 - x_3 & \geq & -2 \\ x_1, x_2, x_3 & \geq & 0 \end{cases}$$

The values of x_1, x_2, x_3 that maximize Z and its maximum value are

(a) $x_1 = 1, x_2 = 0, x_3 = 0$ and $Z = 2$ (correct)
(b) $x_1 = 0, x_2 = 2, x_3 = 0$ and $Z = 2$
(c) $x_1 = 0, x_2 = 0, x_3 = -2$ and $Z = 2$
(d) $x_1 = 1, x_2 = 1, x_3 = 1$ and $Z = 2$
(e) $x_1 = 0, x_2 = 3, x_3 = 1$ and $Z = 2$

2. The last simplex tableau for a **Dual** maximization problem is set as

Basic variables	y_1	y_2	S_1	S_2	S_3	b
S_1	0	0	1	$\frac{3}{5}$	$-\frac{1}{5}$	$\frac{11}{5}$
y_2	0	1	0	$\frac{2}{5}$	$\frac{1}{5}$	$\frac{9}{5}$
y_1	1	0	0	$-\frac{1}{5}$	$\frac{2}{5}$	$\frac{8}{5}$
W	0	0	0	$\frac{4}{5}$	$\frac{7}{5}$	$\frac{43}{5}$

Then, the solution for **Primal** minimization problem is

(a) $x_1 = 0$, $x_2 = \frac{4}{5}$, $x_3 = \frac{7}{5}$, and minimum $Z = \frac{43}{5}$ (correct)
(b) $x_1 = \frac{8}{5}$, $x_2 = \frac{9}{5}$, $x_3 = 0$, and minimum $Z = \frac{43}{5}$
(c) $x_1 = \frac{11}{5}$, $x_2 = \frac{7}{5}$, $x_3 = \frac{7}{5}$, and maximum $Z = \frac{43}{5}$
(d) $x_1 = 0$, $x_2 = \frac{9}{5}$, $x_3 = \frac{7}{5}$, and maximum $Z = \frac{43}{5}$
(e) $x_1 = \frac{11}{5}$, $x_2 = \frac{9}{5}$, $x_3 = \frac{8}{5}$, and minimum $Z = \frac{43}{5}$

3. The simplex tableau for a standard maximization problem is set as.

Basic variables	x_1	x_2	x_3	S_1	S_2	S_3	b
x_1	1	$-\frac{1}{2}$	$-\frac{1}{2}$	$\frac{1}{2}$	0	0	1
S_2	0	$-\frac{1}{2}$	$\frac{3}{2}$	$-\frac{1}{2}$	1	0	3
S_3	0	$\frac{3}{2}$	$\frac{5}{2}$	$-\frac{1}{2}$	0	1	5
Z	0	-2	1	1	0	0	2

Then, Z has a maximum value at $(x_1, x_2, x_3, S_1, S_2, S_3) =$

(a) $\left(\frac{8}{3}, \frac{10}{3}, 0, 0, \frac{14}{3}, 0\right)$ and $Z = \frac{26}{3}$ (correct)

(b) $\left(\frac{5}{3}, \frac{5}{3}, 0, 0, \frac{8}{3}, 2\right)$ and $Z = \frac{26}{3}$

(c) $\left(\frac{8}{3}, \frac{5}{3}, 0, 0, \frac{14}{3}, 3\right)$ and $Z = \frac{26}{3}$

(d) $\left(\frac{5}{3}, \frac{10}{3}, 0, 0, \frac{4}{3}, 0\right)$ and $Z = \frac{26}{3}$

(e) $\left(\frac{8}{3}, \frac{5}{3}, 0, 0, 0, \frac{4}{3}\right)$ and $Z = \frac{26}{3}$

4. In how many ways, is it possible to answer of Multiple Choice Examination? If there are 3 questions having five choices and 5 questions having three choices. Exactly one choice is selested for each question.

(a) 30375 (correct)

(b) 15625

(c) 59049

(d) 84375

(e) 11250

5. A bank offers 4% compound interest calculated on half-yearly basis. A customer deposits 1000 SR each on 1st January and 1st July of a year. At the end of the year, the amount he would have gained by way of interest is

(a) 60.4 (correct)
(b) 2060.4
(c) 1040.4
(d) 40.4
(e) 2080.4

6. Suppose that 700 SR amounted to 862 SR in a savings account after three years. If interest was compounded quarterly, find the nominal rate of interest?

(a) 7% (correct)
(b) 7.5%
(c) 23.14%
(d) 9%
(e) 9.62%

7. What is the best investment?

   (a) 8.1% Compounded monthly (correct)
   (b) 8% Compounded daily
   (c) 8.12% Compounded quarterly
   (d) 8.15% Compounded semianuualy
   (e) 8.3% Compounded annualy

8. To what sum will in seven years if 4200 SR amount is invested at a 6% compounded semiannually?

   (a) 6352.87 SR (correct)
   (b) 6315.25 SR
   (c) 6385.55 SR
   (d) 6372.33 SR
   (e) 6430.15 SR

9. A debt of 6000 SR due in five years and 10,000 SR in seven years is to be repaid by a payment of 5000 SR in three years and a final payment at the end of six years. If the interest rate is 2.5% compounded annually, how much is the final payment?

(a) 10521.64 SR (correct)
(b) 12000 SR
(c) 11328.52 SR
(d) 9336.27 SR
(e) 8952.37 SR

10. A debt of 5000 SR due five years from now and 5000 SR due ten years from now is to be repaid by a payment of 2000 SR in two years, a payment of 4000 SR in four years, and a final payment at the end of six years. If the interest rate is 2.5% compounded annually, how much is the final payment?

(a) 3244.63 SR (correct)
(b) 3344.63 SR
(c) 2344.63 SR
(d) 3424.63 SR
(e) 4244.63 SR

11. Suppose that you can invest 18000 SR in a business that gurarantees you cash flow 7000 SR, 10000 SR, 8000 SR at the end of years 4, 7, and 8 respectively. Assume an interest rate of 5% compounded annually. The net present value of the cash flow is

(a) 280.44 SR (correct)
(b) -280.44 SR
(c) 420.44 SR
(d) -420.44 SR
(e) 0

12. If 7000 SR is invested at an annuall rate of 4% compounded continuously, find the compound amount at the end of eight years?

(a) 9639.89 SR (correct)
(b) 83227.73 SR
(c) 10321.75 SR
(d) 9823.62 SR
(e) 8743.15 SR

13. What annual rate compounded continuously is equivalent to an effective rate of 8% ?

(a) 7.69% (correct)
(b) 6.69%
(c) 5.69%
(d) 7.0%
(e) 8.69%

14. A man places 2000 SR in a saving account that earns interest at the rate of 6% compounded quarterly. The man also deposits 1000 SR in the account at the end of every quarter at the same rate for the three years. The value of the account at the end of three years is

(a) 15432.44 SR (correct)
(b) 17432.44 SR
(c) 16432.44 SR
(d) 14432.44 SR
(e) 18432.44 SR

15. Given an interest rate of 5% compounded annually, find the present value of a generalized annuity of 4000 SR, due at the end of each year for three years, and 6000 SR, due thereafter at the end of each year for four years.

(a) 29271.74 (correct)

(b) 23485.369

(c) 34378.361

(d) 21762.12

(e) 22762.12

16. Find the present value of an annuity of 2000 SR per quarter for $4\frac{1}{2}$ years at an interest rate of 8% compounded quarterly.

(a) 29984.06 SR (correct)

(b) 20984.06 SR

(c) 39984.06 SR

(d) 19984.06 SR

(e) 22984.06 SR