MATHEMATICS 1115A — 2004 FALL TEST 2

SECTION ________ **NAME (PRINTED)** ______________________________

Student Number ______________ **SIGNATURE** __________________________

Only calculators without memory or graphics are allowed. **Each multiple choice question is worth 1 mark. All work is to be shown on this question paper in the space provided and *the answer selected must be entered on the attached answer sheet.* Both the question paper and the answer sheet, *both* with completed identification sections, must be handed in.**

The first two questions involve the problem:

$$\text{Maximize} \quad Z = 2x + 2y$$

$$\text{Subject to} \quad \begin{cases} 2x - y & \geq & -4 \\ x - 2y & \leq & 4 \\ x + y & = & 6 \\ x, y & \geq & 0 \end{cases}$$

1. The number of corner points of the feasible region is:

   (A) 2 (B) 5 (C) 3 (D) 1 (E) 4

2. The number of points at which Z attains a maximum value is:

   (A) infinitely many (B) 0 (C) 2 (D) 1 (E) none of these

The next three questions involve the problem:

$$\text{Maximize} \quad Z = 4x_1 + 5x_2 - 3x_3 - x_4$$

$$\text{Subject to} \quad \begin{cases} x_1 + x_3 - x_4 & \leq 2 \\ x_1 + x_2 + x_4 & \leq 5 \\ x_1 + x_2 - x_3 + x_4 & \leq 3 \\ x_1, x_2, x_3, x_4 & \geq 0 \end{cases}$$

3. The initial simplex table(au) for this problem is:

(A)
$$\begin{array}{c} \\ s_1 \\ s_2 \\ s_3 \\ Z \end{array} \begin{array}{c} \begin{array}{cccccccc} x_1 & x_2 & x_3 & x_4 & s_1 & s_2 & s_3 & Z \end{array} \\ \left[\begin{array}{cccccccc|c} 1 & 0 & 1 & -1 & 1 & 0 & 0 & 0 & 2 \\ 1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 & 5 \\ 1 & 1 & -1 & 1 & 0 & 0 & 1 & 0 & 3 \\ \hline 4 & 5 & -3 & -1 & 0 & 0 & 0 & 1 & 0 \end{array}\right] \end{array}$$

(B)
$$\begin{array}{c} \\ s_1 \\ s_2 \\ s_3 \\ Z \end{array} \begin{array}{c} \begin{array}{cccccccc} x_1 & x_2 & x_3 & x_4 & s_1 & s_2 & s_3 & Z \end{array} \\ \left[\begin{array}{cccccccc|c} 1 & 0 & 1 & -1 & -1 & 0 & 0 & 0 & 2 \\ 1 & 1 & 0 & 1 & 0 & -1 & 0 & 0 & 5 \\ 1 & 1 & -1 & 1 & 0 & 0 & -1 & 0 & 3 \\ \hline -4 & -5 & 3 & 1 & 0 & 0 & 0 & 1 & 0 \end{array}\right] \end{array}$$

(C)
$$\begin{array}{c} \\ s_1 \\ s_2 \\ s_3 \\ Z \end{array} \begin{array}{c} \begin{array}{cccccccc} x_1 & x_2 & x_3 & x_4 & s_1 & s_2 & s_3 & Z \end{array} \\ \left[\begin{array}{cccccccc|c} 1 & 0 & 1 & -1 & 1 & 0 & 0 & 0 & 2 \\ 1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 & 5 \\ 1 & 1 & -1 & 1 & 0 & 0 & 1 & 0 & 3 \\ \hline -4 & -5 & 3 & 1 & 0 & 0 & 0 & 1 & 0 \end{array}\right] \end{array}$$

(D)
$$\begin{array}{c} \\ s_1 \\ s_2 \\ s_3 \\ Z \end{array} \begin{array}{c} \begin{array}{cccccccc} x_1 & x_2 & x_3 & x_4 & s_1 & s_2 & s_3 & Z \end{array} \\ \left[\begin{array}{cccccccc|c} 1 & 0 & 1 & -1 & 1 & 0 & 0 & 0 & -2 \\ 1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 & -5 \\ 1 & 1 & -1 & 1 & 0 & 0 & 1 & 0 & -3 \\ \hline -4 & -5 & 3 & 1 & 0 & 0 & 0 & 1 & 0 \end{array}\right] \end{array}$$

(E) none of these

4. The pivot entry is found in:

(A) row s_3, column x_2 (B) row s_2, column x_3 (C) row s_2, column x_1
(D) row s_1, column x_2 (E) none of these, there is no pivot entry

5. The value of the objective function in the "next table(au)" is:

(A) 20 (B) -15 (C) 8 (D) 15 (E) 25

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6. For a function C, one can find "$\min C$" as:

(A) $\max(-C)$ (B) $-\max(C)$ (C) $-\max(C^{-1})$ (D) $-\max(-C)$ (E) $(\max(C^{-1}))^{-1}$

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7. A company manufactures three products X,Y, and Z. Each product requires machine time and finishing time as in the following table:

	Machine Time	Finishing Time
X	1 hour	4 hours
Y	2 hours	4 hours
Z	3 hours	8 hours

The number of hours of machine time and finishing time available per month are 900 and 5000, respectively. The unit profit on X,Y, and Z is \$6, \$8, and \$12, respectively. The company wants to know the maximum possible amount of its monthly profit. With obvious notation, the company's problem gives rise to an LP problem with initial table(au):

$$\text{(A)}\quad \begin{array}{c} \\ x \\ y \\ z \\ P \end{array}\begin{array}{c} \begin{array}{cccccc} m & f & s_1 & s_2 & s_3 & \end{array} \\ \left[\begin{array}{ccccc|c} 1 & 4 & 1 & 0 & 0 & 6 \\ 2 & 4 & 0 & 1 & 0 & 8 \\ 3 & 8 & 0 & 0 & 1 & 12 \\ \hline -900 & -5000 & 0 & 0 & 0 & 0 \end{array}\right] \end{array} \qquad \text{(B)}\quad \begin{array}{c} \\ s_1 \\ s_2 \\ P \end{array}\begin{array}{c} \begin{array}{ccccccc} x & y & z & s_1 & s_2 & P & \end{array} \\ \left[\begin{array}{cccccc|c} 1 & 2 & 3 & 1 & 0 & 0 & 900 \\ 4 & 4 & 8 & 0 & 1 & 0 & 5000 \\ \hline -6 & -8 & -12 & 0 & 0 & 1 & 0 \end{array}\right] \end{array}$$

$$\text{(C)}\quad \begin{array}{c} \\ x \\ y \\ z \\ P \end{array}\begin{array}{c} \begin{array}{cccccc} m & f & s_1 & s_2 & s_3 & \end{array} \\ \left[\begin{array}{ccccc|c} 1 & 4 & 1 & 0 & 0 & 6 \\ 2 & 4 & 0 & 1 & 0 & 8 \\ 3 & 8 & 0 & 0 & 1 & 12 \\ \hline 900 & 5000 & 0 & 0 & 0 & 0 \end{array}\right] \end{array} \qquad \text{(D)}\quad \begin{array}{c} \\ s_1 \\ s_2 \\ P \end{array}\begin{array}{c} \begin{array}{ccccccc} x & y & z & s_1 & s_2 & P & \end{array} \\ \left[\begin{array}{cccccc|c} 1 & 2 & 3 & 1 & 0 & 0 & 900 \\ 4 & 4 & 8 & 0 & 1 & 0 & 5000 \\ \hline 6 & 8 & 12 & 0 & 0 & 1 & 0 \end{array}\right] \end{array}$$

(E) none of these

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8. A Canadian postal code consists of a string of six characters, of which three are letters and three are digits, which begins with a letter, and for which each letter is followed by a (single) digit. The number of possible Canadian postal codes is:

(A) exactly enough for each Canadian to have their very own postal code
(B) more than enough for each Canadian to have their very own postal code
(C) 1000 (D) 17,576 (E) 17,576,000

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9. A die is rolled four times. The number of results that are possible if the order of the rolls is considered and the second roll is even is:

(A) 432 (B) 648 (C) 21 (D) 20 (E) none of these

10. A waiter takes the following order from a table of seven people: three hamburgers, two cheese-burgers, and two steak sandwiches. Upon returning with the food, he forgets who ordered what and simply places an order in front of each person. The number of ways the waiter can do this is:

(A) 7! (B) 5040 (C) 1260 (D) none of these (E) 210

11. A personnel director must hire six people: four for the assembly department and two for the shipping department. There are 10 applicants all of whom are equally qualified to work in either department. The number of ways the personnel director can fill the positions is:

(A) 3150 (B) 8 (C) ${}_{10}C_4 \cdot {}_{10}C_2$ (D) ${}_{10}C_6$ (E) none of these

12. A red die and a green die are thrown and the numbers on each are noted. Of the following events

$$
\begin{aligned}
E &= \{\text{both are even}\} \\
F &= \{\text{both are odd}\} \\
G &= \{\text{sum is 2}\} \\
H &= \{\text{sum is 4}\} \\
I &= \{\text{sum is greater than 10}\}
\end{aligned}
$$

the complete collection of mutually exclusive pairs is:

(A) E and F, E and G, E and I, F and I, G and H, G and I, H and I
(B) E and F, G and H (C) none of these (D) E and F, E and G, F and I, G and H, G and I
(E) E and F, E and G, G and H,

13. Two cards from a standard deck of 52 playing cards are drawn *without replacement.* The probability that one card is a king and the other is a heart is:

(A) none of these (B) $\frac{51}{2704}$ (C) $\frac{52}{2704}$ (D) $\frac{13}{338}$ (E) $\frac{51}{1352}$

14. A clothing store maintains its inventory of ties so that 40% are 100% pure silk. If a tie is selected at random then the probability that it is not 100% pures silk is:

(A) $\frac{2}{5}$ (B) $\frac{3}{5}$ (C) $\frac{3}{6}$ (D) $\frac{4}{5}$ (E) $\frac{3}{7}$

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15. On an eight-question multiple-choice test there are four choices for each answer, only one of which is correct. If a student answers each question randomly then the probability that she answers exactly four questions correctly is:

(A) $\frac{81}{256}$ (B) $\frac{2835}{32,768}$ (C) $\frac{162}{256}$ (D) none of these (E) $\frac{1}{32,768}$

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16. A family has three children. If at least one child is a boy then the probability that it has at least two girls is:

(A) $\frac{7}{3}$ (B) $\frac{4}{7}$ (C) $\frac{7}{4}$ (D) $\frac{3}{7}$ (E) $\frac{1}{2}$

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17. Barbara Smith, a sales representative, is staying overnight at a hotel and has a breakfast meeting with an important client the following morning. She asked the hotel to give her a 7 A.M. wake-up call in the morning, to be on time for the meeting. The probability that the hotel will remember to call is 0.9. If she gets the call, the probability that she will be on time is 0.9. If she does not get the call, the probability that she will be on time is 0.4. The probability that she will be on time is:

(A) 0.85 (B) 0.81 (C) 1.00 (D) 0.40 (E) 1.17

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18. If $P(E|F) = \frac{2}{3}$, $P(E \cup F) = \frac{17}{18}$, and $P(E \cap F) = \frac{5}{9}$ then:

(A) E and F are dependent (B) E and F are mutually exclusive (C) E and F are independent
(D) E and F are not independent (E) E and F are complementary

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19. In the game of Monopoly, if a player throws three consecutive 'doubles' with a pair of dice then the player 'goes to jail'. The probability of this happening is:

(A) $\frac{1}{2}$ (B) $\frac{1}{64}$ (C) $\frac{1}{216}$ (D) $\frac{3}{216}$ (E) $\frac{1}{125}$

Questions 20 and 21 deal with the following situation: An automobile maker has four plants: A, B, C, and D. The percentage of total daily output that are produced by the four plants are 35%, 20%, 30%, and 15%, respectively. The percentage of faulty units produced by the plants are estimated to be 2%, 5%, 3%, and 4%, respectively.

20. The probability that a car both comes from A and is faulty is:

(A) 0.37 (B) undefined (C) 0.007 (D) 0 (E) .02

21. If a car on a dealer's lot is selected at random and found to be faulty then the probability that it came from A is:

(A) $\frac{70}{25}$ (B) $\frac{7}{320}$ (C) $\frac{9}{32}$ (D) $\frac{7}{25}$ (E) $\frac{7}{32}$

Questions 22 and 23 deal with the following situation: In 1990, 75% of all smokers predicted that they would be smoking five years later, event R (and therefore 25% of all smokers predicted that they would not be smoking five years later, event R'). Five years later, 70% of those who predicted that they would be smoking did not smoke, and of those who predicted that they would not be smoking 90% did not smoke.

22. The probability that a person who predicted that he/she would be smoking five years later, in fact did not smoke five years later is:

(A) 1.45 (B) 0.145 (C) 0.70 (D) 0.225 (E) 0.525

23. The percentage of those who do not smoke and predicted that they would be smoking is:

(A) 52.5% (B) 70% (C) 77% (D) 73% (E) 69%

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24. A fast-food restaurant estimates that if it opens a restaurant in a shopping centre then the probability that the restaurant will be successful is 0.65. A successful restaurant earns an annual profit of $75,000; an unsuccessful restaurant sustains an annual loss of $20,000. The expected gain from opening a restaurant in a shopping centre is:

(A) $75,000 (B) $27,500 (C) $55,750 (D) $41,750 (E) none of these

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25. For a certain large population, the probability that a randomly selected person has a computer is 0.6. If four persons are selected at random then the probability that at least three of them have a computer is:

(A) ${}_4P_3(0.6)^3(0.4) + 4!(0.6)^4$ (B) ${}_4C_3(0.6)^3(0.4)$ (C) ${}_4P_3(0.6)^3(0.4)$ (D) ${}_4C_3(0.6)^3(0.4) + (0.6)^4$ (E) 0

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