Prince Sultan University
MATH 101
Major III Exam
First Semester 2009/2010, Term 091
Wednesday, January 20, 2010

Time Allowed: 100 minutes

Name: _____ ID Number: _____

Section Number: _____ Instructor Name: _____

Important Instructions:

- You may use CASIO scientific calculator that does not have programming or graphing capabilities.
- You may **NOT borrow** a calculator from anyone.
- There should be **NO talking** during the examination.
- Your exam will be taken **immediately** without any warning if your mobile is seen or heard.
- You must show all your work beside the problem. Be organized.
- You may use the back of the pages for extra space, but be sure to indicate that on the page with the problem.
- This examination has **17** problems, some with several parts. Make sure that your paper has all these problems.

Problems	Max points	Student's Points
1,2,3,4	20	
5,6,7,8	20	
9,10,11,12	20	
13,14,15	20	
16,17	20	
Total	100	

Q1. (3 points) How many subsets of the set {a, b, c} are there? List all the subsets.

Q2. (6 points) Let $U = \{a, b, c, d, e, f, i, o, u, w, y, z\}$ be the *universal set*, $A = \{a, b, c, d, e, f\}$, and $B = \{a, e, i, o, u, w, y\}$. Compute the following:

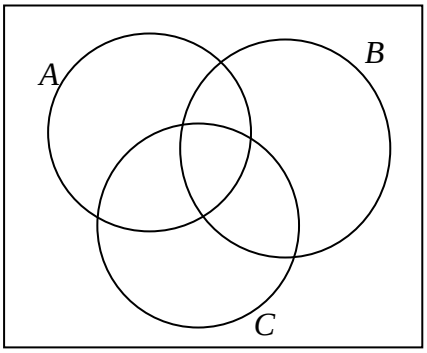
a) $n(A \cap B)$ =

b) $n(A \cup B)$ =

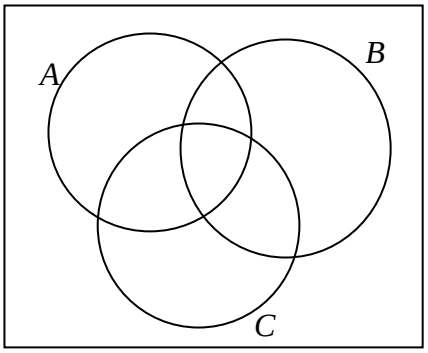
c) $n(\bar{A} \cup \bar{B})$ =

Q3. (6 points) Consider three sets *A*, *B* and *C*. Use a Venn diagram to shade the following sets:

a) $(A \cap B) \cup C$



b) $\bar{A} \cap \bar{B} \cap \bar{C}$

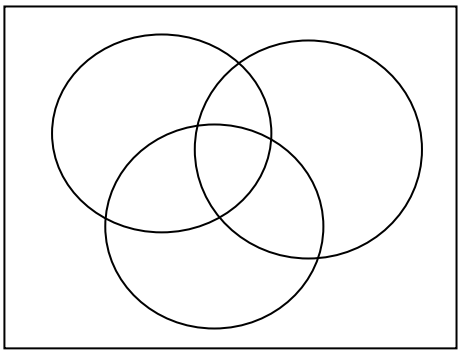


Q4. (5 points) If $n(A) = 20$, $n(B) = 30$, $n(A \cup B) = 45$, and $n(\bar{A} \cap \bar{B}) = 10$. Find the following:

a) $n(A \cap B)$

b) $n(U)$ *where* U *is the universal set.*

Q5. (10 points) In a survey of 100 students from PSU, it is found that 40 are taking Mathematics, 60 are taking Science, 50 are taking Chemistry, 25 are taking Mathematics and Science, 20 are taking Mathematics and Chemistry, 22 are taking Science and Chemistry, and 10 are taking all three of these subjects.



a) How many students are taking mathematics but neither of the other two subjects?

b) How many students are taking Chemistry but not Science?

c) How many students are taking Mathematics or Chemistry?

d) How many students are taking none of the three subjects?

e) How many students are taking exactly two different subjects?

Q6. (3 points) On a single shelf we are to arrange 5 computer service books and 7 mathematics books. In how many ways can this be done if the computer science books are to be grouped together and the mathematics books are to be grouped together?

Q7. (3 points) A club has 12 members. In how many ways can 4 officers consisting of a president, vice-president, secretary, and treasurer be chosen in order?

Q8. (4 points) How many different 11-letters words (real or imaginary) can be formed from the letters in the word "MATHEMATICS"?

Q9. (7 points) A test consists of 10 true-false questions and 8 multiple-choice questions.

a) In how many ways can a student select 6 true-false and 5 multiple-choice to answer?

b) In how many ways can a student select 10 questions, at least 8 of which are multiple-choice?

Q10. (4 points) A group of 9 people is going to be formed into committees of 4, 3, and 2 people. How many committees can be formed if no person can serve on more than one committee?

Q11. (6 points) Use the Binomial Theorem to expand the expression$(2x - 3y)^4$**. Show all your steps.**

Q12. (3 points) What is the coefficient of x^8 in the expansion of $(\mathbf{x + 3})^{\mathbf{10}}$**? Show all your steps.**

Q13. (4 points) A social security number has 9 digits. How many social security numbers are there? The U.S. population in the year 2000 was about 281 million. Is it possible for every U.S. resident to have a unique social security number? (Assume no restrictions.)

Q14. (8 points) One hundred shoppers at a local shopping mall were categorized by age and gender as shown in the frequency distribution below**:** One shopper is selected at random from that group of 100 shoppers.

a) What is the probability that the randomly selected shopper is under 25 years of age?

Gender	**Under 25 year A_1**	**25-40 years A_2**	**Over 40 years A_3**	**Total**
Male(M)	15	13	12	
Female(F)	24	18	18	
Total				

b) What is the probability that the randomly selected shopper is male?

c) What is the probability that the randomly selected shopper is male and under 25 years of age?

d) What is the probability that the randomly selected shopper is female or over 40 years of age?

Q15. (8 points) If E and F are events with $P(E \cup F) = \frac{5}{8}$, $P(E \cap F) = \frac{1}{3}$, and $P(E) = \frac{1}{2}$, find the following: **Show all your steps**

a) $P(\bar{E}) =$

b) $P(F) =$

c) $P(\bar{F})=$

d) Are E and F mutually exclusive? **<u>Explain why?</u>**

Q16. (10 points) A fair coin is tossed 6 times.

a) Find the probability that no tail appears.

b) Find the probability that exactly 2 tails appear.

c) Find the probability that at least 3 tails appear.

Q17. (10 points) Suppose that 3 cars are defective in a production run of 40 cars. A sample of 4 is to be selected to be checked for defects.

a) How many different samples can be chosen?

b) How many samples will contain **exactly one defective** car?

c) What is the probability that a randomly chosen sample will contain **exactly one defective** car?

d) Find the probability that randomly chosen sample will contain **at least one defective** car.