



MATH 110: General Education Math

Fall 2026

Homework 1

Name: _____

1. (6 pts) Let $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ be the universal set, and let $A = \{2, 4, 6, 8, 10\}$ and $B = \{1, 2, 3, 4, 5\}$.

(a) Find $|A|$. _____

(b) Find $A \cup B$. _____

(c) Find $A \cap B$. _____

(d) Find A^c . _____

2. (6 pts) A hospital ID badge consists of a letter (A–Z), followed by a digit (0–9), followed by another letter (A–Z). Letters and digits may be repeated. How many different badges are possible?

3. (6 pts) Compute each of the following without a calculator, showing your work.

(a) $6!$

(b) $\frac{8!}{6!}$

(c) $\frac{7!}{3!4!}$

4. (6 pts) In how many different orders can 6 patient charts be stacked on a nurse's desk?

5. (6 pts) A hospital needs to choose 3 nurses from a pool of 11 to form a rapid-response team. The team members have no distinct roles. How many different teams are possible?

6. (14 pts) The table below shows the eight patients on a hospital ward, whether each has received a flu shot this season, and whether each has type 2 diabetes.

Patient	Flu shot	Type 2 diabetes
Ana	Yes	No
Ben	Yes	Yes
Carla	No	No
David	Yes	No
Eva	No	Yes
Frank	Yes	Yes
Gloria	No	No
Hector	Yes	No

Using first initials, let U be the set of all eight patients, let V be the set of patients who have received a flu shot, and let T be the set of patients with type 2 diabetes.

- (a) (3 pts) Write U , V , and T by listing their elements.
- (b) (1 pt) Find $|U|$, $|V|$, and $|T|$.
- (c) (2 pts) Find $V \cup T$ and $V \cap T$.
- (d) (2 pts) Find V^c . Describe the patients in V^c in words.
- (e) (2 pts) Is $T \subseteq V$? Explain.
- (f) (2 pts) Are V and T disjoint? Explain.
- (g) (2 pts) Compare $|V \cup T|$ with $|V| + |T|$. Why are they different?

7. (14 pts) A clinic sends each patient a confirmation code made of two letters (A–Z) followed by three digits (0–9), such as KR502.

(a) (3 pts) How many codes are possible if letters and digits may be repeated?

(b) (3 pts) How many codes are possible if the two letters must be different, but digits may be repeated?

(c) (4 pts) How many codes are possible if no letter and no digit may be repeated?

(d) (4 pts) In part (c), the digits available for the second digit depend on which digit was chosen first. Explain why the Fundamental Principle of Counting can still be used.

8. (14 pts)

(a) (4 pts) Compute $1!$, $2!$, $3!$, $4!$, $5!$, and $6!$.

(b) (4 pts) Simplify $\frac{10!}{8!}$ without computing $10!$ or $8!$. Show your work.

(c) (3 pts) Simplify $\frac{100!}{98!}$.

(d) (3 pts) A student claims that $\frac{6!}{3!} = 2!$, since $\frac{6}{3} = 2$. Show that the student is wrong by computing both sides.

9. (14 pts) A pharmacy has 12 different medications on a shelf, but there is only room to display 5 of them in the front display case, arranged in a row from left to right.

(a) (3 pts) How many choices are there for the first (leftmost) spot in the display? For the second spot? For the third, fourth, and fifth spots?

(b) (2 pts) Use the Fundamental Principle of Counting and your answer to part (a) to find the number of possible displays.

(c) (3 pts) Write your answer to part (b) as a permutation number ${}_nP_k$, and check it using the formula ${}_nP_k = \frac{n!}{(n-k)!}$.

(d) (3 pts) Suppose instead the display case had room for all 12 medications. How many displays would be possible? (You may leave your answer as a factorial.)

(e) (3 pts) Write your answer to part (d) as a permutation number ${}_nP_k$. What does the formula ${}_nP_k = \frac{n!}{(n-k)!}$ give in this case, and why does it agree with part (d)?

10. (14 pts) A clinic has 7 nurses, and 3 of them will be chosen to attend a training session.
- (a) (3 pts) Suppose the 3 nurses chosen will present at the training first, second, and third. In how many ways can they be chosen? Is this a permutation or a combination problem?
- (b) (3 pts) Suppose instead the 3 nurses chosen will simply attend, with no distinct roles. In how many ways can they be chosen? Is this a permutation or a combination problem?
- (c) (3 pts) Your answer to part (a) should be 6 times your answer to part (b). Explain why.
- (d) (3 pts) Compute ${}_7C_4$ and compare it with your answer to part (b). Explain in words why choosing 3 nurses to attend the training is the same as choosing 4 nurses to stay at the clinic.
- (e) (2 pts) A coin is tossed 5 times. How many different sequences of heads and tails have exactly 2 heads?