MTH210 Midterm Exam **Name:**
Duration: 90 minutes **Point:** **/100**

dd/mm is your birthday. Let d=dd (example dd=03, d=3) and m=mm.

Question 1. (20 points) The weights of certain machine components are normally distributed with a mean of (100+d) gram and a standard deviation of m gram. Find the d percentile (the value separate the top (100-d) % and the bottom d %. (*Theses weights could serve as limits used to identify which components should be rejected.*)

Question 2. (20 points) Given $X=N(\mu;\sigma^2)$ where $\mu=(d+m)$ and $\sigma=m$. Find the following probabilities:

a) $P(X>d+2m)$
b) $P(X<d-m)$

Question 3. (30 points) An Associates Market Research found that (d+m)% of Americans do not think that having a college education is important to succeed in the business world. If a random sample of fifty Americans is selected, find these probabilities.

a. Exactly m people will agree with that statement.
b. At most m+1 people will agree with that statement.
c. Fewer than d people will agree with that statement.

Question 4. (30 points) You are invited to participate in a game at a carnival. Here are the rules:

Entry Fee: You pay $10 to play.

Game Mechanics: The game involves drawing a card randomly from a standard deck of 52 playing cards and then spinning a fair wheel divided into 4 equally likely outcomes (A, B, C, D).

Rewards:

If you draw a spade:
Spin result A: You win $50.
Spin result B: You win $30.
Spin result C: You win $10.
Spin result D: You win nothing.

If you draw a red card (hearts or diamonds):
Spin result A: You win $20.
Spin result B: You win $15.
Spin result C: You win $5.
Spin result D: You win nothing.

If you draw a club:
Spin result A: You win $40.
Spin result B: You win $20.
Spin result C: You win $10.
Spin result D: You win nothing.

Profit: Your profit is your total winnings minus the $10 entry fee.

a) Calculate the expected profit of this game based on the probability distribution of outcomes.

Is this game fair for the player? Justify your answer.

b) Suppose the entry fee is reduced to $8. How would this impact the expected profit? Would the game now be favorable to the player?

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