# Intro to Probability
# Day 2
# (Compound events & their probabilities)

# Compound Events

Let *A*, and *B* be two event. Then we can define 3 new events as follows:

1) *A or B* (also $A \cup B$ )
…is the list of all outcomes in *A* together with those in *B*
(i.e. an outcome is in *A* or *B* if it's in *A* or in *B* or both)

2) *A and B* (also $A \cap B$ )
…is the list of all outcomes that are in both *A* and *B*

3) *not A* (also $\bar{A}$ )
…is the list of all outcomes of *S* that are not in *A*

Definition: Events A and B are <u>disjoint</u> or <u>mutually exclusive</u> if $A \cap B = \emptyset$.

Ex 1:

Experiment

Roll a single die once

Events

$A$ = The die lands on an even number

$B$ = The die lands on a multiple of 3

$C$ = The die lands on a prime number

$D$ = The die lands on 4

$E$ = The die lands on a number bigger than 2

Find

$A \cup E,\ B \cup D,\ C \cap E,\ B \cap D,\ \bar{B},\ \bar{E}$

Question:

Are the events $A$ and $B$ disjoint? How about $A$ and $E$?

Ex 2:

Experiment

Draw a single card from a standard poker deck

Events

$A$ = Draw a heart

$B$ = Draw a black card

$C$ = Draw a red face card

$D$ = Draw a king

$E$ = Draw a card that has a number on it that is less than 5

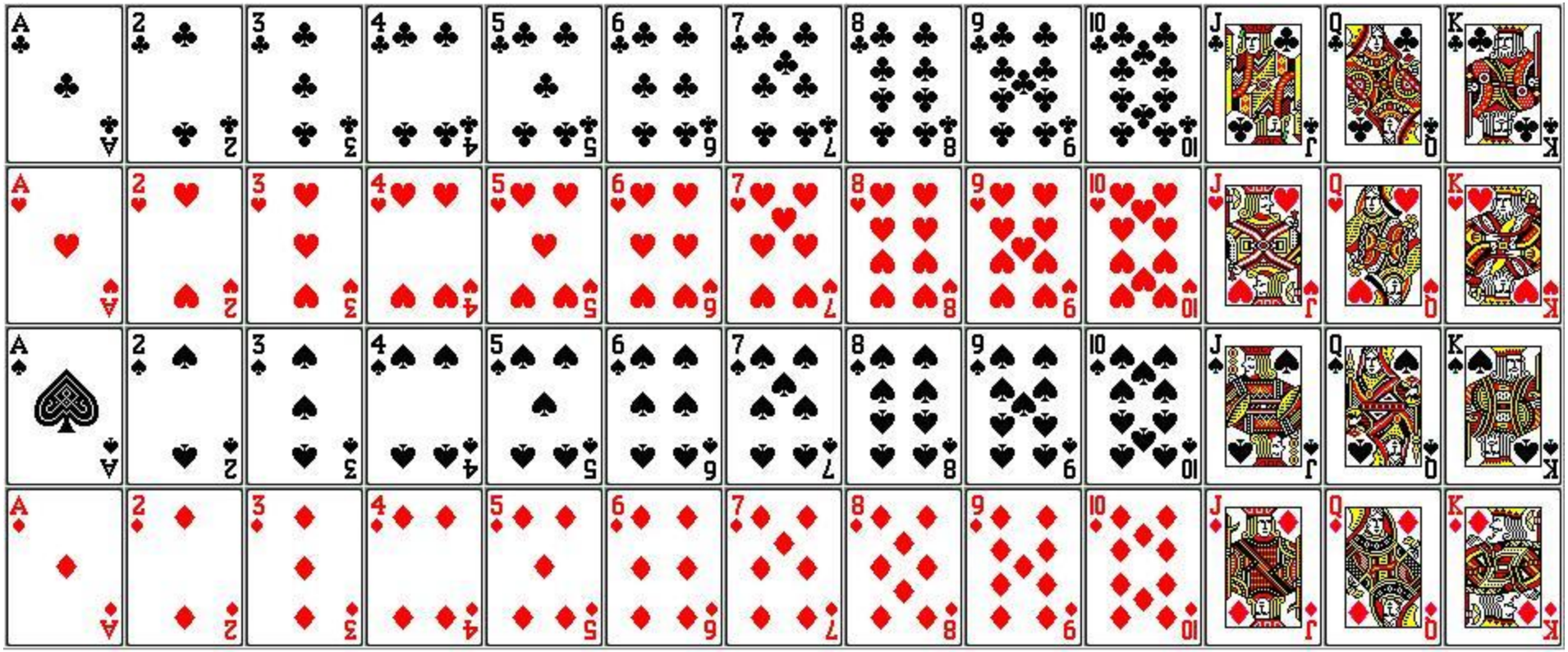
Find

$D \cup E,\ A \cap D,\ \bar{B}$

Question:

Which pairs of events above are disjoint?

# Ex 2: Picture



# Formulas for $P(A \cup B)$, $P(A \cap B)$, & $P(\bar{A})$

## Formulas for $P(A \cup B)$ (the addition rule)

1) If $A$ and $B$ are disjoint (i.e. $A \cap B = \emptyset$), then

$$P(A \cup B) = P(A) + P(B)$$

2) If $A$ and $B$ are NOT disjoint (i.e. $A \cap B \neq \emptyset$), then

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

Ex 1:

Experiment

Roll a single die once

Events

$A$ = The die lands on an even number

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$E$ = The die lands on a number bigger than 2

Find

$P(A \cup E)$, $P(B \cup D)$

Ex 2:

Experiment

Draw a single card from a standard poker deck

Events

$A$ = Draw a heart

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$D$ = Draw a king

$E$ = Draw a card that has a number on it that is less than 5

Find

$D \cup E$ , $P(D \cup E)$

# Ex 2: Picture