

CMPUT 397 Reinforcement Learning:

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Admin review

- Getting good grades is difficult in this course \checkmark
- There is no late submission allowed \checkmark
- Our office hours & email addresses are given in the course page \checkmark
- Graded notebook (programming assignment) due this Friday \checkmark
- Practice quiz for mini-course 1, module 2 (Markov Decision Processes) due \checkmark this Sunday
- Reading book chapters is a must (otherwise low marks in mid-term/final exam) \checkmark
- Bring paper or tablet each day \checkmark

Probabilities review

- \checkmark of an event: P(A)
- What kind of object is *P*? \checkmark
- What kind of object is A? \checkmark
- Is the sample space an event? \checkmark
- Definition of conditional probability: $P(A \mid B) = P(A \cap B) / P(B) \neq P(A)$ \checkmark
- What kind of object is *B*? \checkmark
- ✓ Law of total probabilities: $P(B) = \sum_k P(B \cap A_k) = \sum_k P(B \mid A_k) P(A_k)$
- What are the conditions on A_k ? \checkmark

A probability is a non-negative number mapped from an event denoting likelihood

Expectations & conditional expectations

An expected value of a random variable is a weighted average of possible \checkmark outcomes, where the weights are the probabilities of those outcomes

 $E[X] = \sum_{x \in \mathcal{X}} P(X=x)$

An expected value of a random variable conditional on another event is a \checkmark probabilities of those outcomes given the event

$$E[X | Y=y] = \sum_{x \in \mathcal{X}} P(X=x | Y=y)$$

Expectation conditional on a random variable *E*[X | Y] itself is a random variable, which is a function g(Y) of another random variable Y

weighted average of possible outcomes, where the weights are the conditional

Properties of expectations

- $\checkmark \quad \text{Linearity: } E[X + Y] = E[X] + E[Y]$
- ✓ Linearity: E[aX] = aE[X]
- ✓ Non-multiplicativity: $E[XY] \neq E[X] E[Y]$
- ✓ Law of the unconscious statistician: $E[g(X)] = \sum g(x) P(X=x)$

$g(X)] = \sum_{x \in \mathscr{X}} g(x) P(X=x)$

Expectations: example

 In the double dice-rolling exper the sum of the two dice?

In the double dice-rolling experiment, What is the expected value of

Expectations: example

✓ Show that E[X] = E[E[X | Y]]