Expected Value
E[X]

In probability theory, the expected value of a random variable X, often denoted E(X), E[X] ...and EX...is a generalization of the weighted average, and is intuitively the arithmetic mean of a large number of independent realizations of X.

The expected value is also known as the expectation, mathematical expectation, mean, average, or first moment. Expected value is a key concept in economics, finance, and many other subjects

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Equation:

$$E[X] = \sum_{i=1}^{N} x_i \, p_i$$

where:

EX: expected value

X : the outcome value
P: the occuring propability of X

exemple :
assume that your are a retailer , you want to buy a product (A), you find two quality of the same product ... original with price of 1000$ .. and fake with price = 600$ .... if you buy the original.. the propability to sell it in 2 month =0.6 ... and the propability of sell it in 4 month = 0.2 , as for the fake product the propa of sell it in 3 month = 0.2 and the propability of sell it in 8 month=0.7.... where the profits for both products is equal ..

whats the decision that you gonna make????
lets calc the Expected value for Original

E[X] = (2*0.6) + (4*0.2)
E[X] = 2

for Fake:
E[X] = (3*0.2) + (8*0.7)
E[X] = 6.2

its better to buy the original product because its take short time to sell it, unlike fake product ..it may take a long time .....

another exemple:
you are stock exchange trader , and after analysis you conclude that if you trade on gold at the current price the propability of acheive 5000$ of profit is 0.6 and the stop loss = -1500 with propability of 0.5,
on the other hand you see another apportunity on oil , if you trade on oil you earn 3500$ with propability of 0.8 .. but also you can loss -200 . propability of loss = 0.2

you are confused! ...you trade on gold or oil ?

the exepected value of gold:

E[X] = (5000*0.6)+(-1500*0.5)
E[X] = 3000 -750 = 2250$

the expected value of oil:
E[X] = (3500*0.8)+(-200*0.2)
E[X] = 2800 -40 = 2760$

its better to trade on Oil

exempe 3:

assume that you want to buy a car , the price of new car = 120,000$, you find same car with price = 88,000$ but its old and broken ..and need to be fixed , the renovation cost you from 25,000$ to 48,000$, nothing is for sure!! the propability of fixing your car for 25,000$ is 0.2 .... where the propability of fix it with price of 32,000$ is 0.4 ..and the propabiliy of fix it with price of 45,000$ is 0.8 ??

wich car you gonna buy ?????????
you can buy the old car , and if you lucky , the renovation it will cost you only 25,000$ but dont be sure ? it may also cost you 45,000$

ok lets calc the expected value
E[x] = (25000*0.2)+(32000*0.4)+(45000*0.8)
E[x] = 53800$

total cost of the old car = 88000+ renovation = 141800$
where the new car its cost you only 120000$

its better to buy a new car

this is the general idea of the expected value .

exemple of the expected value using pascal .....

```
// Expected VALUE
// M.Aek Progs Angedevil AD

program Project1;

{$APPTYPE CONSOLE}

{$R *.res}

uses
System.SysUtils;

var
i,N,input:longint;
x:array of double;
p:array of double;
E: double;
begin

setlength(x,1000);
setlength(p,1000);
writeln('--------Expected Value (M.Aek Progs AD) -------');

i:=0;
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```
while(true) do begin
writeln(’input outcome (x):’+i.ToString());
try
readln(x[i]);
except
on E: exception do begin
writeln(’Invalid value!!!’);
i:=0;
continue;
end;
end;
writeln(’input propability (p):’+i.ToString());

try
readln(p[i]);
except
on E: exception do begin
writeln(’Invalid value!!!’);
i:=0;
continue;
end;
end;

writeln(’Calc E[X]: 1       Input Next data: 2 ‘);
try
readln(input);
except
on E: exception do begin
writeln(’Invalid value!!!’);
i:=0;
continue;
end;
end;
```

```
if(input = 2) then begin
i:= i+1;
continue;
end

else if(input = 1) then begin
N:=i;
E:=0;
for I := 0 to N do begin
E := E + (x[i]*p[i]);
end;
writeln('Expected Value:   E[X]= '+E.ToString());
writeln('');
writeln('');
writeln('');
i:=0;
end

else  begin
i:=0;
E:=0;
N:=0;
end;

end;

end.
```