Probability distributions

Binomial distribution:

$$P(r)=\binom{n}{r}p^r q^{n-r}$$

$$\mu = np$$

$$\sigma=\sqrt{npq}$$

Poisson distribution:

$$P(r)=e^{-\lambda}\frac{\lambda^r}{r!},\quad \lambda=np$$

$$\mu=\lambda$$

$$\sigma=\sqrt{\lambda}$$

Normal (Gaussian) distribution:

$$f(x)=\frac{1}{\sigma\sqrt{2\pi}}e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

Standard normal distribution:

$$f(z)=\frac{1}{\sqrt{2\pi}}e^{-\frac{1}{2}z^2}$$

$\boxed{\text{Standardising formula: } z=\frac{x-\mu}{\sigma}}$

p.34

Binomial coefficients

$$\binom{n}{r}={}^nC_r=C(n,r)=\frac{n!}{r!(n-r)!}$$

Some values of ${}^nC_r$:

n \ r	0	1	2	3	4	5	6	7	8
0	1								
1	1	1							
2	1	2	1						
3	1	3	3	1					
4	1	4	6	4	1				
5	1	5	10	10	5	1			
6	1	6	15	20	15	6	1		
7	1	7	21	35	35	21	7	1	
8	1	8	28	56	70	56	28	8	1
9	1	9	36	84	126	126	84	36	9
10	1	10	45	120	210	252	210	120	45
11	1	11	55	165	330	462	462	330	165
12	1	12	66	220	495	792	924	792	495
13	1	13	78	286	715	1287	1716	1716	1287
14	1	14	91	364	1001	2002	3003	3432	3003
15	1	15	105	455	1365	3003	5005	6435	6435

28. The chest measurements of teenage male customers for T-shirts may be modelled by a normal distribution with mean 101 cm and standard deviation 5 cm. Find the probability that a randomly-selected customer will have a chest measurement which is

(i) less than 103 cm

(ii) 98 cm or more

(iii) between 95 and 100 cm.

p.34 $\boxed{z=\frac{x-\mu}{\sigma}}$

$\mu = 101$ cm

$\sigma = 5$ cm

(i) $z=?$ if $x=103$

$P(X<103\text{ cm})=?$

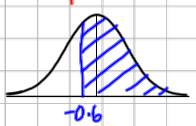
$z=\frac{103-101}{5}=\frac{2}{5}=0.4$

$P(z<0.4)=65.54\%$

(ii) $z=?$ if $x=98$

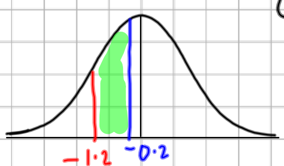
$P(X>98\text{ cm})=?$

$z=\frac{98-101}{5}=\frac{-3}{5}=-0.6$



$P(z>-0.6)=P(z<0.6)=72.57\%$

(iii)



$X=95 \Rightarrow z=\frac{95-101}{5}=\frac{6}{5}=-1.2$

$X=100 \Rightarrow z=\frac{100-101}{5}=\frac{-1}{5}=-0.2$

$P(-1.2<z<-0.2)=P(0.2<z<1.2)=P(z<1.2)-P(z<0.2)$

By Symmetry

$=88.49\%-57.93\%=30.56\%$