TG 7 Find the probability of obtaining 4, 5, 6 or 7 Heads when a fair coin is tossed 12 times

(a) using the binomial theorem.

(b) using a normal approximation to the binomial distribution.

Projectmaths has provided this probability table extract:

		r										
	z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	
	0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133	
	0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389	
	1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177	
	1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319	
(a) Using Binomial distribution:						7881.7910.7939.7967.7995.8023.8051.8078.8106.8133.8159.8186.8212.8238.8264.8289.8315.8340.8365.83899032.9049.9066.9082.9099.9115.9131.9147.9162.9177.9192.9207.9222.9236.9251.9265.9279.9292.9306.9319stribution:As $np < 10$, use continuity correction:P($3.5 \le X \le 7.5$)Consider $X = 3.5$: $z = \frac{3.5-6}{1.7321}$ $z(0.5)^6 + {}^{12}C_7(0.5)^7(0.5)^5$ From the table, $z = 1.44$ gives 0.9251 , so -1.44 gives $1 - 0.9251 = 0.0749$ 55						
P(X = 4 or X = 5 or X = 6 or X = 7)						$P(3.5 \le X \le 7.5)$						
$= {}^{12}C_4(0.5)^4(0.5)^8 + {}^{12}C_5(0.5)^5(0.5)^7$						Consider X = 3.5: $z = \frac{3.5 - 6}{1.7321}$						
+ ${}^{12}C_6(0.5)^6(0.5)^6$ + ${}^{12}C_7(0.5)^7(0.5)^5$						= -1.44 (2 dec pl)						
= 0.73	32 (4 de	3 .7881 .7910 .7939 .7967 3 .8159 .8186 .8212 .8238 3 .9032 .9049 .9066 .9082 4 .9192 .9207 .9222 .9236 ial distribution: $X = 5$ or $X = 6$ or $X = 7$) $y^4(0.5)^8 + {}^{12}C_5(0.5)^5(0.5)^7$ $y^4(0.5)^6 + {}^{12}C_7(0.5)^5(0.5)^7$ $y = 0.5^6(0.5)^6 + {}^{12}C_7(0.5)^7(0.5)^5$ $y = 0.5$			From the table, $z = 1.44$ gives 0.9251,							
(b) Using Normal distribution:						so -1.44 gives 1 - 0.9251 = 0.0749.						
n = 12						7.5-6						
P(head	P(head) = p = 0.5 Consider $X = 7.5$: $z = \frac{7.5 - 6}{1.7321}$											
$np = 12 \times 0.5$						= 0.87 (2 dec pl)						
= 6 (NB: $np < 10$)					From the table, $z = 0.87$ gives 0.8078.							
$\sigma = \sqrt{np(1-p)}$					Hence, P(4, 5, 6 or 7) = 0.8078 – 0.0749							
$=\sqrt{6(1-0.5)}$						= 0.7329						
$= \sqrt{6(1-0.5)}$												
= 1.7321 (4 dec pl)												
						1						

* These solutions have been provided by projectmaths and are not supplied or endorsed by NESA.

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