

11	(a)		e.g. The probability of side effects is the same for each patient (or is constant) e.g. The patients (or cases) are independent oe e.g. Patients form random sample of the population	B1 [1]	1.2 Allow any indication of context, eg "patient" or "side effects"	NOT Prob of patients getting side effects is indep or random. Ignore all else
----	-----	--	--	------------------------------------	---	---

11			See exemplars at end. Allow 2 sf throughout				
11	(b)		$H_0: p = 0.097$ where p is the proportion of patients experiencing side-effects (within a year) or 9.7% of patients experience side-effects $H_1: p > 0.097$ or $> 9.7\%$ exp side-effects $B(450, 0.097)$ & $X = 50$ (allow 51) $P(X \geq 51) = 1 - 0.862 = 0.138$ (3 sf) Compare 0.1 Insufficient evidence to reject H_0 Allow "Not reject H_0" Allow Accept H_0 No evidence (at 10% level) that proportion experiencing side-effects in one year under new treatment is greater than under standard treatment	B1 B1 M1 A1 A1f M1 A1f [7]	1.1 2.5 3.3 3.4 1.1 1.1 2.2b	Allow "possibility" or, "probability" Not $p =$ percentage having disease One error, eg undefined p, $p = 9.7\%$ B1B0 stated or implied eg by 0.138 or 0.107 or 0.108 or 0.862 or 0.893 or 0.0308 or 0.0366 NB 0.138 seen (or 0.107 or 0.108 or 0.862 or 0.893) implies M1 even if part of incorrect statement, eg $P(X \leq 51) = 0.107$ or $P(X > 51) = 0.138$ cao BC Dep 0.138 or 0.107 or 0.108 only Must see this statement oe Dep 0.138 or 0.107 or 0.108 or $P(X \geq 51$ or 50) stated Any equivalent statement, in context, not definite, eg allow "likelihood", "percentage" Ignore all else ft only their $P(X \geq 51)$ and NB possible opposite conclusion on ft 0.108 seen: max B1B1M1A0A1M1A1 Bin(450, 0.1) <u>used</u>: max B1B1M0A0A0M1A1	If 2-tail test: $H_0: p = 0.097$ (defined p) B1 $H_1: p \neq 0.097$ B0 M1 A1 Comp 0.05 A1 No more marks Condone "Reject H_1" Might be implied by conclusion NB possible opposite conclusion on ft NOT eg "change" NOT "proportion experiencing side effects is not significantly greater" Context can be implied by, eg, "patients", "proportion"

Qu 11(b) Exemplar solutions

A $H_0: p = 0.097$ $H_1: p > 0.097$ B1B0 $P(X \geq 51) = 0.138$ M1A1 $0.138 > 0.1$ A1 Reject H_1 M1A0	D $H_0: p = 0.097$ $H_1: p > 0.097$ where $p = P(\text{a patient exp side effects})$ B1B1 $P(X \leq 51) = 0.108$ M1A0 $0.108 > 0.1$ A1 Not reject H_0 M1 There is not enough evidence that the alternative hypothesis is correct (No context) A0
B $H_0: p = 0.097$ $H_1: p > 0.097$ where $p = \text{\%age exp'ng side effects}$ B1B0 $P(X \geq 51) = 0.107$ M1A0 $0.107 > 0.1$ A1 Not reject H_0 M1A0	E Let p be the probability $H_0: p = 0.097$ $H_1: p > 0.097$ B1B0 Bin(51, 0.097) Ignore because next line is correct $P(X \leq 51) = 0.138$ M1A1 $0.138 > 0.1$ A1 Not reject H_0 M1 Under new treatment there is not a greater prop exp side effects A0
C $H_0: p = 0.097$ $H_1: p > 0.097$ where $p = \text{proportion exp'ng side effects}$ B1B1 Bin(450, 0.097) $P(X \leq 51) = 0.138$ M1A1 $0.138 > 0.1$ A1 Not reject H_0 M1 Under new treatment there is not a greater prop exp side effects A0	F $H_0 = 0.097$ $H_1 > 0.097$ B0B0 Bin(450, 0.1) $P(X \geq 51) = 0.192$ M0A0 $0.192 > 0.1$ A0 Reject H_1 M1 Insuff evidence that under new treatment there is a greater prop exp side effects A1 G $H_0: p = 0.097$

$H_1: p > 0.097$ where $p = P(\text{a patient exp side effects})$	B1B1
$\text{Bin}(450, 0.097)$, $X = 51$ or $X = 50$	M1
$p = 0.0308$	A0
$0.0308 < 0.1$	A0
Reject H_0	M0
There is evidence that under new treatment there is a greater prop exp side effects	A0

J	$H_0: p = 0.097$	
H	$H_0: p(X = 0.097)$	
	$H_1: p(X > 0.097)$	B0B0
	$P(X \geq 51) = 0.0308$	M1A0
	$0.0308 < 0.1$	A0
	Reject H_0	M1
	There is enough evidence that a greater prop exp side effects	A1f

I	$H_0: p = 0.097$	
	$H_1: p > 0.097$	B1B0
	$p = 0.138$	M1A1
		A0
	Reject H_1	M1
		A0

$H_1: p > 0.097$	B1B0
$X \sim \text{Bin}(450, 0.097)$	
$p = 0.893$	M1A0
$0.893 > 0.1$	A0
Not reject H_0	M0 A0

K	$H_0: p = 0.097$	
	$H_1: p > 0.097$ p is the likelihood of a patient exp side effects	B1B1
	$P(X \geq 51) = 0.893$	M1A0
	$0.893 > 0.1$	A0
	Not reject H_0	M1
	No reason to think proportion decreased	A1

L	$H_0: p = 0.97$	
	$H_1: p = 0.97$	B0B0
	$P(X \geq 50) = 0.0366$	M1A0
	$0.0366 < 0.1$	A0
	Reject H_0 There is evidence prop has increased	M1A1f