

S2: Profi Rhagdybiaelchau - Dau Ddosraniad Normal

Haf 2005

- (6) (a) $\mu_M =$ cymedr y merched. $M \sim N(\mu_M, 1.5^2)$
 $\mu_B =$ cymedr y bechgyn. $B \sim N(\mu_B, 1.5^2)$
 $H_0: \mu_M = \mu_B$ yn erbyn
 $H_1: \mu_M \neq \mu_B$.

$$\begin{array}{ll} \text{(b)} \sum m = 105.1 & \sum b = 86.7 \\ \bar{m} = \frac{105.1}{8} & \bar{b} = \frac{86.7}{6} \\ \bar{m} = 13.1375 & \bar{b} = 14.45 \end{array}$$

$$\begin{aligned} \text{Y gwerth-}p &= P(\bar{M} = \bar{B}) \\ &= P(\bar{M} - \bar{B} = 0) \end{aligned}$$

$$\begin{aligned} \text{Gan fod } 13.1375 - 14.45 &= -1.3125 \\ &< 0 \end{aligned}$$

$$\text{Y gwerth-}p \text{ yw } 2P\left(\bar{M} - \bar{B} \leq \frac{\bar{m} - \bar{b} - 0}{SE(\bar{M} - \bar{B})}\right)$$

$$\begin{aligned} \text{Nawr } SE(\bar{M} - \bar{B}) &= \sqrt{\frac{1.5^2}{8} + \frac{1.5^2}{6}} \\ &= 0.8100925873. \end{aligned}$$

$$\begin{aligned} \text{Felly'r gwerth-}p \text{ yw } &2P\left(\bar{M} - \bar{B} \leq \frac{-1.3125}{0.8100925873}\right) \\ &= 2P(Z \leq -1.620185175) \\ &= 2P(Z \geq 1.620185175) \\ &= 2(1 - P(Z < 1.62)) \\ &= 2(1 - 0.94738) \\ &= 2 \times 0.05262 \\ &= 0.10524 \end{aligned}$$

- (c) Gan fod $0.10524 > 0.05$, nid oes digon o dystiolaeth i gyfiawnhau gwrthod H_0 , felly i ddweud bod y cymedrau yn wahanol.

Haf 2006

- (7) (a) $\mu_A =$ cymedr Model A $A \sim N(\mu_A, 1.5^2)$
 $\mu_B =$ cymedr Model B $B \sim N(\mu_B, 1.5^2)$
 $H_0: \mu_A = \mu_B$ yn erbyn
 $H_1: \mu_A \neq \mu_B.$

$$\begin{array}{l} \text{(b) } \Sigma a = 501 \\ \bar{a} = \frac{501}{6} \\ \bar{a} = 83.5 \end{array} \qquad \begin{array}{l} \Sigma b = 489 \\ \bar{b} = \frac{489}{6} \\ \bar{b} = 81.5 \end{array}$$

$$\begin{aligned} \text{Y gwerth-}p &= P(\bar{A} = \bar{B}) \\ &= P(\bar{A} - \bar{B} = 0). \end{aligned}$$

$$\text{Gan fod } 83.5 - 81.5 = 2 > 0$$

$$\text{y gwerth-}p \text{ yw } 2P\left(\bar{A} - \bar{B} \geq \frac{\bar{a} - \bar{b} - 0}{SE(\bar{A} - \bar{B})}\right)$$

$$\begin{aligned} \text{Nawr } SE(\bar{A} - \bar{B}) &= \sqrt{\frac{1.5^2}{6} + \frac{1.5^2}{6}} \\ &= 0.8660254038 \quad \left(\text{neu } \frac{\sqrt{3}}{2}\right) \end{aligned}$$

$$\begin{aligned} \text{Felly'r gwerth-}p \text{ yw } &2P\left(\bar{A} - \bar{B} \geq \frac{2}{0.8660254038}\right) \\ &= 2P(Z \geq 2.309401077) \\ &= 2(1 - P(Z \leq 2.31)) \\ &= 2(1 - 0.98956) \\ &= 2 \times 0.01044 \\ &= 0.02088 \end{aligned}$$

- (i) Ar lefel arwyddocâd 1%, mae $0.02088 > 0.01$
felly nid oes digon o dystiolaeth i gyfiawnhau gwrthod
 H_0 - rydym yn derbyn bod y ddau drawl yr un peth.
- (ii) Ar lefel arwyddocâd 5%, mae $0.02088 < 0.05$

Felly mae'r sampl yn darparu tystiolaeth gref ar gyfer gwrthod H_0 - rydym yn derbyn bod y ddau draul yn wahanol.

Haf 2007

- (7) (a) (i) $\mu_A =$ cymedr hylif 1 $A \sim N(\mu_A, 0.025^2)$
 $\mu_B =$ cymedr hylif 2 $B \sim N(\mu_B, 0.025^2)$
 $H_0: \mu_A = \mu_B$ yn erbyn
 $H_1: \mu_A \neq \mu_B$.

$$\begin{array}{l} \text{(ii) } \sum a = 31.71 \\ \bar{a} = \frac{31.71}{5} \\ \bar{a} = 6.342 \end{array} \qquad \begin{array}{l} \sum b = 31.53 \\ \bar{b} = \frac{31.53}{5} \\ \bar{b} = 6.306 \end{array}$$

$$\begin{aligned} \text{Y gwerth-}p &= P(\bar{A} = \bar{B}) \\ &= P(\bar{A} - \bar{B} = 0) \end{aligned}$$

$$\begin{aligned} \text{Gan fod } \bar{a} - \bar{b} &= 6.342 - 6.306 \\ &= 0.036 \\ &> 0 \end{aligned}$$

$$\text{y gwerth-}p \text{ yw } 2P\left(\bar{A} - \bar{B} \geq \frac{\bar{a} - \bar{b} - 0}{SE(\bar{A} - \bar{B})}\right)$$

$$\begin{aligned} \text{Nawr } SE(\bar{A} - \bar{B}) &= \sqrt{\frac{0.025^2}{5} + \frac{0.025^2}{5}} \\ &= 0.0158113883. \end{aligned}$$

$$\begin{aligned} \text{Felly'r gwerth-}p \text{ yw } &2P\left(\bar{A} - \bar{B} \geq \frac{0.036}{0.0158113883}\right) \\ &= 2P(Z \geq 2.276839915) \\ &= 2(1 - P(Z < 2.28)) \\ &= 2(1 - 0.98870) \\ &= 2 \times 0.0113 \\ &= 0.0226 \end{aligned}$$

Gan fod $0.0226 < 0.05$ mae'r sampl yn darparu tystiolaeth gref ar gyfer gwrthod H_0 . Felly rydym yn derbyn bod lefelau asidedd y ddau hylif yn wahanol.

$$(b) \quad \bar{A} - \bar{B} \sim N(\bar{a} - \bar{b}, SE(\bar{A} - \bar{B})^2)$$

$$\bar{A} - \bar{B} \sim N(0.036, 0.00025)$$

Cyfrwng hyder 95% felly $\frac{z}{2} = 2.5\%$ ym mhob cynffon. O'r tablau, $P(Z \leq 1.960) = 0.975$.

$$\begin{aligned} \text{Cyfrwng hyder 95\%} &= \bar{a} - \bar{b} \pm 1.960 SE(\bar{A} - \bar{B}) \\ &= 0.036 \pm 1.960 \times \sqrt{0.00025} \\ &= 0.036 \pm 0.03099032107 \\ &= [0.005, 0.067] \text{ i 3 lle degol.} \end{aligned}$$

Haf 2009

(4)

(a) $\mu_X =$ cymedr y merched
 $\mu_Y =$ cymedr y bechgyn
 $H_0: \mu_X = \mu_Y$ yn erbyn
 $H_1: \mu_X \neq \mu_Y$.

$$X \sim N(\mu_X, 0.5^2)$$

$$Y \sim N(\mu_Y, 0.5^2)$$

$$(b) \quad \sum x = 94.8$$

$$\sum y = 81.0$$

$$\bar{x} = \frac{94.8}{6}$$

$$\bar{y} = \frac{81}{5}$$

$$6$$

$$5$$

$$\bar{x} = 15.8$$

$$\bar{y} = 16.2$$

$$\begin{aligned} Y \text{ gwerth-}p &= P(\bar{X} = \bar{Y}) \\ &= P(\bar{X} - \bar{Y} = 0). \end{aligned}$$

$$\text{Gan fod } \bar{x} - \bar{y} = 15.8 - 16.2$$

$$= -0.4$$

$$< 0$$

$$Y \text{ gwerth-}p \text{ yw } 2P\left(\bar{X} - \bar{Y} \leq \frac{\bar{x} - \bar{y} - 0}{SE(\bar{X} - \bar{Y})}\right)$$

$$\begin{aligned} \text{Nawr } SE(\bar{X}-\bar{Y}) &= \sqrt{\frac{0.5^2}{6} + \frac{0.5^2}{5}} \\ &= 0.3027650354. \end{aligned}$$

$$\begin{aligned} \text{Felly'r gwerth-p yw } 2P\left(\bar{X}-\bar{Y} \leq \frac{-0.4}{0.3027650354}\right) \\ &= 2P(Z \leq -1.321156518) \\ &= 2P(Z \geq 1.321156518) \\ &= 2P(1 - P(Z < 1.32)) \\ &= 2(1 - 0.90658) \\ &= 2 \times 0.09342 \\ &= 0.18684 \end{aligned}$$

Gan bod $0.18684 > 0.05$ nid oes digon o dystiolaeth ar gyfer cyfiau'n hysgwirhod H_0 . Felly rydym yn derbyn bod bechgyn a merched yn cymryd yr un amser cyfartalog i adatrys posau jigsaw.

Haf 2010

$$\begin{aligned} \textcircled{3} \quad (a) \quad A &\sim N(\mu_A, 0.2^2) \\ \bar{A} &= \frac{1}{3}(A_1 + A_2 + A_3) \end{aligned}$$

$$\begin{aligned} \text{Nawr } \sum a_i &= 11.5 + 11.7 + 11.6 \\ &= 34.8 \end{aligned}$$

$$\bar{a} = \frac{34.8}{3}$$

$$\bar{a} = 11.6$$

Cyfwng hyder 95% felly $\frac{5}{2} = 2.5\%$ ym mhob cymffon. o'r tablau, $P(Z \leq 1.960) = 0.975$.

$$\begin{aligned} \text{Cyfwng hyder 95\%} &= \bar{a} \pm 1.960 SE(\bar{A}) \\ &= 11.6 \pm 1.960 \times \sqrt{\frac{0.2^2}{3}} \\ &= 11.6 \pm 0.2263213055 \\ &= [11.374, 11.826] \text{ i 3 lle degol.} \end{aligned}$$

(b) (i) $\mu_B =$ cymedr mesuriadau pwysau B

$$B \sim N(\mu_B, 0.2^2)$$

$$H_0: \mu_B = 12 \text{ yn erbyn}$$

$$H_1: \mu_B > 12.$$

$$(ii) \sum b = 12.1 + 12.2 + 12.4 + 12.1$$

$$= 48.8$$

$$\bar{b} = \frac{48.8}{4}$$

$$\bar{b} = 12.2$$

$$\text{Y gwerth-}p = P(\bar{B} > 12)$$

$$= P(\bar{B} - 12 > 0)$$

$$= P\left(Z > \frac{\bar{b} - 12}{SE(\bar{B})}\right)$$

$$\text{Nawr } SE(\bar{B}) = \sqrt{\frac{0.2^2}{4}}$$

$$= 0.1$$

$$\text{Felly'r gwerth-}p \text{ yw } P\left(Z > \frac{12.2 - 12}{0.1}\right)$$

$$= P(Z > 2)$$

$$= 1 - P(Z \leq 2)$$

$$= 1 - 0.97725$$

$$= 0.02275$$

Gan fod $0.02275 < 0.05$ mae'r sampl yn darparu tystiolaeth gref ar gyfer gwrthod H_0 . Felly rydym yn derbyn honiad Emyr bod B yn pwysu mwy na 12g.

$$(c) A \sim N(\mu_A, 0.2^2)$$

$$\bar{A} = \frac{1}{3}(A_1 + A_2 + A_3)$$

$$\bar{a} = 11.6$$

$$B \sim N(\mu_B, 0.2^2)$$

$$\bar{B} = \frac{1}{4}(B_1 + B_2 + B_3 + B_4)$$

$$\bar{b} = 12.2$$

Mae dosraniad samplu $\bar{A} - \bar{B}$ yn normal gyda chymedr

$$E(\bar{A} - \bar{B}) = \bar{a} - \bar{b}$$

$$= 11.6 - 12.2$$

$$= -0.6$$

a chyfeiliornad safonol $SE(\bar{A} - \bar{B}) = \sqrt{\frac{0.2^2}{3} + \frac{0.2^2}{4}}$

$$= 0.1527525232$$

Cyfwng hyder 90% felly $\frac{10}{2} = 5\%$ ym mhob cymffwrdd.
Or tablau, $P(Z \leq 1.645) = 0.95$

$$\begin{aligned} \text{Cyfwng hyder 90\%} &= \bar{a} - \bar{b} \pm 1.645 SE(\bar{A} - \bar{B}) \\ &= -0.6 \pm 1.645 \times 0.1527525232 \\ &= [-0.851, -0.349] \text{ i 3 ll.d.} \end{aligned}$$

(Neu $[0.349, 0.851]$ ar gyfer $\bar{B} - \bar{A}$.)

Haf 2011

(4) (a) $\mu_G =$ cymedr anifeiliaid guryw $G \sim N(\mu_G, 0.5^2)$

$\mu_B =$ cymedr anifeiliaid benyw $B \sim N(\mu_B, 0.5^2)$

$H_0: \mu_G = \mu_B$ yn erbyn

$H_1: \mu_G \neq \mu_B$.

(b) $\sum g = 114.8$

$$\bar{g} = \frac{114.8}{8}$$

$$8$$

$$\bar{g} = 14.35$$

$$\sum b = 98$$

$$\bar{b} = \frac{98}{7}$$

$$7$$

$$\bar{b} = 14$$

$$Y \text{ gwerth-}p = P(\bar{G} = \bar{B}) \\ = P(\bar{G} - \bar{B} = 0)$$

$$\text{Gran foch } \bar{g} - \bar{b} = 14.35 - 14 \\ = 0.35$$

$$> 0$$

$$Y \text{ gwerth-}p \text{ yw } 2P\left(\bar{G} - \bar{B} \geq \frac{\bar{g} - \bar{b} - 0}{SE(\bar{G} - \bar{B})}\right)$$

$$\text{Nawr } SE(\bar{G} - \bar{B}) = \sqrt{\frac{0.5^2}{8} + \frac{0.5^2}{7}} \\ = 0.2587745848$$

$$\text{Felly'r gwerth-}p \text{ yw } 2P\left(\bar{G} - \bar{B} \geq \frac{0.35}{0.2587745848}\right) \\ = 2P(Z \geq 1.352528496) \\ = 2(1 - P(Z < 1.35)) \\ = 2(1 - 0.91149) \\ = 2 \times 0.08851 \\ = 0.17702$$

Ar y lefel arwyddocaâd 5%, gan fod $0.17702 > 0.05$ nid oes digon o dystiolaeth i gyfiawnhau gwrthod H_0 . Felly rydym yn derbyn honiad y swolegydd bod y pwysau cymedrig yn hafal.

Haf 2012

⑤

(a) μ_D = cymedr Dafydd

μ_M = cymedr Meilyr

H_0 : $\mu_D = \mu_M$ yn erbyn

H_1 : $\mu_D \neq \mu_M$.

$$D \sim N(\mu_D, 1.5^2)$$

$$M \sim N(\mu_M, 1.5^2)$$

$$\begin{aligned} \sum d &= 890.4 \\ \bar{d} &= \frac{890.4}{6} \end{aligned}$$

$$\bar{d} = 148.4$$

$$\begin{aligned} \sum m &= 879 \\ \bar{m} &= \frac{879}{6} \end{aligned}$$

$$\bar{m} = 146.5$$

$$\begin{aligned} \text{Y gwerth-p} &= P(\bar{D} = \bar{M}) \\ &= P(\bar{D} - \bar{M} = 0) \end{aligned}$$

$$\begin{aligned} \text{Gran fod } \bar{d} - \bar{m} &= 148.4 - 146.5 \\ &= 1.9 \\ &> 0 \end{aligned}$$

$$\text{Y gwerth-p yw } 2P\left(\bar{D} - \bar{M} \geq \frac{\bar{d} - \bar{m} - 0}{SE(\bar{D} - \bar{M})}\right)$$

$$\begin{aligned} \text{Nawr } SE(\bar{D} - \bar{M}) &= \sqrt{\frac{1.52}{6} + \frac{1.52}{6}} \\ &= 0.8660254038 \end{aligned}$$

$$\begin{aligned} \text{Felly'r gwerth-p yw } &2P\left(\bar{D} - \bar{M} \geq \frac{1.9}{0.8660254038}\right) \\ &= 2P(Z \geq 2.193931023) \\ &= 2(1 - P(Z < 2.19)) \\ &= 2(1 - 0.98574) \\ &= 2 \times 0.01426 \\ &= 0.02852 \end{aligned}$$

Gran fod $0.02852 < 0.05$. mae'r sampl yn darparu bystiolaeth gref ar gyfer gwrthod H_0 . Felly rydym yn derbyn bod gwahaniaeth rhwng y pellterau cymedrig mae Dafydd a Meriwr yn gallu taro pêl golff.

Haf 2013

- ③ (a) $\mu_B =$ cymedr y bechgyn $B \sim N(\mu_B, 7.5^2)$
 $\mu_M =$ cymedr y merched $M \sim N(\mu_M, 7.5^2)$
 $H_0: \mu_B = \mu_M$ yn erbyn $H_1: \mu_B \neq \mu_M$.

$$\begin{aligned} \text{(b)} \quad \sum b &= 482 \\ \bar{b} &= \frac{482}{8} \end{aligned}$$

$$\bar{b} = 60.25$$

$$\begin{aligned} \sum m &= 430 \\ \bar{m} &= \frac{430}{8} \end{aligned}$$

$$\bar{m} = 53.75$$

$$\begin{aligned} \text{Y gwerth-p} &= P(\bar{B} = \bar{M}) \\ &= P(\bar{B} - \bar{M} = 0). \end{aligned}$$

$$\begin{aligned} \text{Gran fod } \bar{b} - \bar{m} &= 60.25 - 53.75 \\ &= 6.5 \\ &> 0 \end{aligned}$$

$$\text{Y gwerth-p yw } 2P\left(\bar{B} - \bar{M} \geq \frac{\bar{b} - \bar{m} - 0}{SE(\bar{B} - \bar{M})}\right).$$

$$\begin{aligned} \text{Nawr } SE(\bar{B} - \bar{M}) &= \sqrt{\frac{7.5^2}{8} + \frac{7.5^2}{8}} \\ &= 3.75 \end{aligned}$$

$$\begin{aligned} \text{Felly'r gwerth-p yw } &2P\left(\bar{B} - \bar{M} \geq \frac{6.5}{3.75}\right) \\ &= 2P(Z \geq \frac{26}{15}) \\ &= 2(1 - P(Z < 1.73)) \\ &= 2(1 - 0.95818) \\ &= 2 \times 0.04182 \\ &= 0.08364 \end{aligned}$$

Gran fod $0.08364 > 0.05$ nid oes digon o dystiolaeth i gyfiawnhau gwrthod H_0 . Felly rydym yn derbyn bod bechgyn a merched yn perfformio cystal â'i gilydd mewn arholiadau mathemateg ymarferol.

S2 Haf 2014

- ③ a) $\mu_G =$ cymedr y gynywod $G \sim N(\mu_G, 0.5^2)$
 $\mu_B =$ cymedr y benywod $B \sim N(\mu_B, 0.5^2)$
 $H_0: \mu_G = \mu_B$ yn erbyn
 $H_1: \mu_G \neq \mu_B$.

b) $\sum g = 39.2$ $\sum b = 46.6$
 $\bar{g} = \frac{39.2}{8}$ $\bar{b} = \frac{46.6}{10}$
 $\bar{g} = 4.9$ $\bar{b} = 4.66$

$$Y \text{ gwerth-}p = P(\bar{G} = \bar{B}) \\ = P(\bar{G} - \bar{B} = 0)$$

$$\text{Gan fod } 4.9 - 4.66 = 0.24 > 0$$

$$y \text{ gwerth-}p \text{ yw } 2P\left(\bar{G} - \bar{B} \geq \frac{\bar{g} - \bar{b} - 0}{SE(\bar{G} - \bar{B})}\right)$$

$$\text{Nawr } SE(\bar{G} - \bar{B}) = \sqrt{\frac{0.5^2}{8} + \frac{0.5^2}{10}} \\ = 0.2371708245$$

$$\text{Felly'r gwerth-}p \text{ yw } 2P\left(\bar{G} - \bar{B} \geq \frac{0.24}{0.2371708245}\right) \\ = 2P(Z \geq 1.011928851) \\ = 2(1 - P(Z < 1.01)) \\ = 2(1 - 0.84375) \\ = 2 \times 0.15625 \\ = 0.3125$$

Gan fod $0.3125 > 0.05$ nid oes digon o dystiolaeth i gyhannu'r gwybodaeth H_0 . Felly rydym yn derbyn bod anifediad gynyw a benyw o'r rhywogaeth newydd yma eifer un pwsau cymedrig.

S2 Haf 2015

- 3) a) $\mu_A = \text{cymedr math A}$
 $\mu_B = \text{cymedr math B}$

$$A \sim N(\mu_A, 1.5^2)$$
$$B \sim N(\mu_B, 1.5^2)$$

$$\sum a = 1612$$

$$\bar{a} = \frac{1612}{8}$$

$$\bar{a} = 201.5$$

$$\sum b = 1584$$

$$\bar{b} = \frac{1584}{8}$$

$$\bar{b} = 198$$

$$\bar{A} - \bar{B} \sim N(\bar{a} - \bar{b}, SE(\bar{A} - \bar{B})^2)$$

$$SE(\bar{A} - \bar{B}) = \sqrt{\frac{1.5^2}{8} + \frac{1.5^2}{8}}$$
$$= 0.75$$

$$\text{Felly } \bar{A} - \bar{B} \sim N(3.5, 0.75^2)$$

Cyfwng hyder 99% Felly $\frac{1}{2} = 0.5\%$ ym mhob cynffon.
o'r tablau, $P(Z \leq 2.576) = 0.995$

$$\text{Cyfwng hyder } 99\% = \bar{a} - \bar{b} \pm 2.576 SE(\bar{A} - \bar{B})$$
$$= 3.5 \pm 2.576 \times 0.75$$
$$= 3.5 \pm 1.932$$
$$= \underline{\underline{[1.568, 5.432]}}$$

b) Cyfwng hyder ?% [2.19, 4.81]

$$4.81 - 2.19 = 2.62$$

$$2.62 \div 2 = 1.31$$

$$\text{Cyfwng hyder ?\%} = 3.5 \pm 1.31$$
$$= 3.5 \pm 1.746 \times 0.75$$

o'r tablau, $P(Z \leq 1.75) = 0.95994$

Felly $100\% - 95.994\% = 4.006\%$ ym mhob cynffon.

Mae hwn felly yn gyfwng hyder $100\% - (2 \times 4.006\%)$
 $= 91.988\% \approx \underline{\underline{92\%}}$

S2 Haf 2016

$$(4) \quad X \sim N(\mu_x, 1.5^2) \qquad Y \sim N(\mu_y, 2.5^2)$$

$H_0: \mu_x = \mu_y$ yn erbyn $H_1: \mu_x \neq \mu_y$.

a) Cyfng hyder 90% felly $\frac{10}{2} = 5\%$ ym mhob cynffon.
 O'r tablau, $P(Z \leq 1.645) = 0.95$.

$$\text{Cyfng hyder } 90\% = \bar{x} - \bar{y} \pm 1.645 SE(\bar{X} - \bar{Y}).$$

$$\begin{aligned} \text{Nawr } SE(\bar{X} - \bar{Y}) &= \sqrt{\frac{1.5^2}{8} + \frac{2.5^2}{12}} \\ &= 0.8955910525 \end{aligned}$$

$$\begin{aligned} \text{Felly'r cyfng hyder } 90\% \text{ yw } \bar{x} - \bar{y} \pm 1.645 \times 0.8955910525 \\ = \bar{x} - \bar{y} \pm 1.473247281 \end{aligned}$$

Felly'r rhanbarth critigol yw $|\bar{x} - \bar{y}| > 1.473247281$
 (felly $k = 1.4732$ i 4 lle degol).

b) (i) $\mu_x - \mu_y = 0.5$

Rydym angen $P(|\bar{X} - \bar{Y}| < 1.4732)$
 pan fo $\bar{X} - \bar{Y} \sim N\left(0.5, \frac{1.5^2}{8} + \frac{2.5^2}{12}\right)$

$$= P(-1.4732 < \bar{X} - \bar{Y} < 1.4732)$$

$$= P\left(\frac{-1.4732 - 0.5}{\sqrt{\frac{1.5^2}{8} + \frac{2.5^2}{12}}} < Z < \frac{1.4732 - 0.5}{\sqrt{\frac{1.5^2}{8} + \frac{2.5^2}{12}}}\right)$$

$$= P(-2.203237733 < Z < 1.08665668)$$

$$= P(-2.20 < Z < 1.09)$$

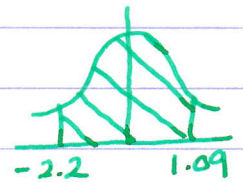
$$= P(Z < 1.09) - P(Z < -2.20)$$

$$= P(Z < 1.09) - P(Z > 2.20)$$

$$= P(Z < 1.09) - (1 - P(Z < 2.20))$$

$$= 0.86214 - (1 - 0.98610)$$

$$= 0.84824$$



(ii) Mae'r tebygolrwydd yn uchel iawn o ddod i'r casgliad anghywir. Dylid cynyddu maint y sampl er mwyn ceisio osgoi hyn.

S2 Haf 2017

$$4) \quad \begin{array}{ll} M_A = \text{cymedr beic modur } A & A \sim N(M_A, 2.5^2) \\ M_B = \text{cymedr beic modur } B & B \sim N(M_B, 2.5^2) \end{array}$$

$$a) \quad \begin{array}{ll} \sum a = 1335.2 & \sum b = 1311.2 \\ \bar{a} = \frac{1335.2}{8} & \bar{b} = \frac{1311.2}{8} \\ \bar{a} = 166.9 & \bar{b} = 163.9 \end{array}$$

$$SE(\bar{A} - \bar{B}) = \sqrt{\frac{2.5^2}{8} + \frac{2.5^2}{8}} \\ = 1.25$$

$$\bar{A} - \bar{B} \sim N(\bar{a} - \bar{b}, SE(\bar{A} - \bar{B})^2)$$

$$\bar{A} - \bar{B} \sim N(166.9 - 163.9, 1.25^2)$$

$$\bar{A} - \bar{B} \sim N(3, 1.5625)$$

Cyfrwng hyder 95% felly $\frac{5}{2} = 2.5\%$ ym mhob cymffon.
o'r tablau, $P(Z \leq 1.960) = 0.975$

$$\begin{aligned} \text{Cyfrwng hyder } 95\% &= \bar{a} - \bar{b} \pm 1.960 SE(\bar{A} - \bar{B}) \\ &= 3 \pm 1.960 \times 1.25 \\ &= 3 \pm 2.45 \\ &= [0.55, 5.45]. \end{aligned}$$

$$b) \quad \begin{array}{l} \text{Mae angen rhif } z \text{ fel bod } z SE(\bar{A} - \bar{B}) = 3 \\ z(1.25) = 3 \\ z = 2.4 \end{array}$$

O'r tablau, mae $P(Z \leq 2.4) = 0.99180$.

Felly mae $100\% - 99.18\% = 0.82\%$ ym mhob cynffon.

Felly mae $0.82\% \times 2 = 1.64\%$ mewn 2 gynffon.

Lefel hyder y cyfngung hyder yw $100\% - 1.64\%$

$$= 98.36\%$$

$$= \underline{98.4\%} \text{ i 3 ffigur ystyrion.}$$

52 Haf 2018

5) a) $\mu_A =$ cymedr ffenestr 1 $A \sim N(\mu_A, 0.02^2)$
 $\mu_B =$ cymedr ffenestr 2 $B \sim N(\mu_B, 0.02^2)$

$H_0: \mu_A = \mu_B$ yn erbyn

$H_1: \mu_A \neq \mu_B$

b) $\Sigma = 9.12$

$\bar{a} = \frac{9.12}{6}$

6

$\bar{a} = 1.52$

$\Sigma = 10.85$

$\bar{b} = \frac{10.85}{7}$

7

$\bar{b} = 1.55$

i) Y gwerth-p = $P(\bar{A} = \bar{B})$
= $P(\bar{A} - \bar{B} = 0)$

Gan fod $1.52 - 1.55 = -0.03$
 < 0

y gwerth-p yw $2P\left(\bar{A} - \bar{B} \leq \frac{\bar{a} - \bar{b} - 0}{SE(\bar{A} - \bar{B})}\right)$

Nawr $SE(\bar{A} - \bar{B}) = \sqrt{\frac{0.02^2}{6} + \frac{0.02^2}{7}}$
= 0.01112697281

Felly'r gwerth-p yw $2P\left(\bar{A} - \bar{B} \leq \frac{-0.03}{0.01112697281}\right)$

= $2P(Z \leq -2.696151103)$

= $2P(Z \geq 2.696151103)$

= $2(1 - P(Z < 2.70))$

= $2(1 - 0.99653)$

= 2×0.00347

= 0.00694

ii) Gan fod $0.00694 < 0.01$ mae'r sampl yn darparu tystiolaeth gref iawn ar gyfer gwrthod H_0 - felly mae tystiolaeth gref iawn iddweud nad yw'r ddwy ffenestr eifer un indecs plygiant.

S2 Haf 2019

$$3) \quad \begin{array}{ll} \mu_1 = \text{cymedr math 1} & A \sim N(\mu_1, 1.5^2) \\ \mu_2 = \text{cymedr math 2} & B \sim N(\mu_2, 1.5^2) \end{array}$$

$$\sum a = 564.9$$

$$\sum b = 464.4$$

$$\bar{a} = \frac{564.9}{7}$$

$$\bar{b} = \frac{464.4}{6}$$

$$\bar{a} = 80.7$$

$$\bar{b} = 77.4$$

$$\bar{A} - \bar{B} \sim N(\bar{a} - \bar{b}, SE(\bar{A} - \bar{B})^2)$$

$$SE(\bar{A} - \bar{B}) = \sqrt{\frac{1.5^2}{7} + \frac{1.5^2}{6}}$$

$$= \sqrt{\frac{39}{56}}$$

$$= 0.8345229604$$

$$\text{Felly } \bar{A} - \bar{B} \sim N(3.3, \frac{39}{56})$$

Cyfunng hyder 95% felly 2.5% ym mhob cynffon.
o'r tablau, $P(Z \leq 1.960) = 0.975$

$$\begin{aligned} \text{Cyfunng hyder 95\%} &= \bar{a} - \bar{b} \pm 1.960 SE(\bar{A} - \bar{B}) \\ &= 3.3 \pm 1.960 \times 0.8345229604 \\ &= \underline{[1.664, 4.936]} \quad \text{i 3 lle degol} \end{aligned}$$